ELECTRICAL REVIEW

Vol CXLVIII No. 3816 12TH JANUARY, 1951

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872

Standard Turbo-Generators

SPEEDING-UP PLANT DELIVERY

SPECIFICATIONS prescribing standardized engineering features or procedure have in the past resulted from a natural evolutionary approach to uniformity of practice among manufacturers, as typified by the objects of the British Standards Institution. Survival of the fittest has permitted insignificant divergencies from the normal to be eliminated by agreement, so that users gain the economic benefits of simplification or know that quotations for plant are made on a common basis. This view of standardization is essentially long-range in its aim.

Rating, Pressure and Temperature

On the other hand the kind of standardization of steam turbo-generating plant which formed the subject of a discussion opened recently by Mr. I. V. Robinson at the Institution of Mechanical Engineers, differs from the foregoing in being based upon a (now repealed) Order of the Ministry of Supply which enjoined conformity with stated conditions. These covered kW ratings, steam pressures and temperatures and bled steam heating for use in this country.

These requirements, though representative of good modern practice, were not in all cases based on many years of manufacturing and operational experience. The purpose behind the Order was important: it was presumably the short-term one of speedy construction of generating plant, with which goes a reduction of the number of spare parts. It also tended to free designers and draughtsmen for meeting more advanced technical needs and to simplify the training of operating staffs.

Larger Sets Desirable

While long enough experience has been gained with 30 MW turbo-alternators to justify some measure of standardization of the formerly accepted kind (and the disappearance of odd ratings round about that capacity is not to be regretted), the same consideration does not apply to 60 MW sets, at least under British conditions; still less does it apply to those of 100 MW, which have been suggested as a further standard, excellent as has been the performance of the two now installed. Nevertheless, the building of 60 and 100 MW machines on basic lines is desirable for increasing national kilowatts quickly, since they are said to take little longer to build than those of smaller output. The feasibility of using the same layout drawings for stations on different sites also seems well worth looking into.

The difficulty of introducing standardization is illustrated by the absence of any attempt, so far as we are aware, to do this for boilers, which take longer to build but for which technical developments are in a greater state of flux. The general problem of providing adequate generating plant in the shortest time possible resembles in some respects that of making armaments during the last war, when standardization of items in bulk proved most effective. An important distinction is that these were relatively short-lived assets, whereas electrical generating plant has to give good performance in reliability and economy for up to 25 years. Such standardization effects a compromise, dictated by the necessity for rapid construction alone. The risk it brings of stifling progress should, however, be avoided by the decision of the British Electricity Authority to take advantage of any engineering advances by ordering one-fifth or so of new plant each year of non-standard character.

COAL SHORTAGE

Mr. P. Noel-Baker, the Minister of Fuel and Power, warned the public on the radio last Saturday that the coal situation was so precarious that unless the strictest economies were made there might be a breakdown of supplies. If the extra three million tons in the next four months, for which the Prime Minister had asked the miners, was forthcoming we should be " reasonably safe "—unless weather conditions interfered with transport. Coming on top of the shortage of generating capacity, this fuel crisis will add to the troubles of the producers and users of electricity. It is to be hoped that in the allocation of coal the Minister and the National Coal Board will recognize the claim of the electricity supply industry to special attention in view of its vital role in industry.

AID FOR INVENTORS

When the Development of Inventions Act, which provided for the setting-up of the National Research Development Corporation, was before the House of Commons some members suggested that the private inventor was not only discouraged but his devices were actually suppressed by industrial concerns whose interests were affected. The Corporation's first report, reviewed in this issue, does not appear to confirm this suspicion. Members of the public put up 485 inventions to the Corporation; at 30th June last only two of these were being exploited although 22 remained under consideration (including 105 cases in which further information was sought from the inventors). About 10 per cent of the 444 inventions received from Government Departments were accepted for development ; the rest were still being considered. Sixteen out of the twenty inventions received from universities are now under active exploitation. Although the Corporation is willing to assist industrial research associations in the development of inventions none of them sought help in the period covered.

UNSHARED BURDEN

At recent meetings of the Eastern Electricity Consultative Council the question has again arisen whether a consumer who pays a heavy price for connection to the supply should be given any relief when later comers secure the advantage of the cable or line which he has paid for. When the contribution has taken the form of a direct payment it is difficult for the Board to refund any of it for it does not seem possible at present to charge the newcomers any part of it. Where, however, the arrangement is for an annual minimum payment the Board might be satisfied by the revenue derived from the other consumers on the section—if there is enough of it. One consideration which may enter into the matter is whether the cable is of a size capable of supplying a large number of consumers. If it is the original consumer has a greater grievance when he has to shoulder the whole burden.

BRIGHTNESS

The topic chosen for discussion at this month's meeting of the I.E.S. in London was that of " brightness engineering," which term has been coined to denote the relationship of brightness to the ease and comfort of seeing. Although most lighting engineers will be aware of the attention that has been paid to the subject in the United States, it is not believed to have been formally discussed in England before. The phrase is not a good one, but neither is " illuminating engineering "; however, the object of the meeting on Tuesday was not to find a better definition of an abstract sensation, but to try to determine what range of brightness—luminosity—was considered permissible in the field of vision.

Film Studio Supplies

1.—*Combined Public and Private Generation Scheme*

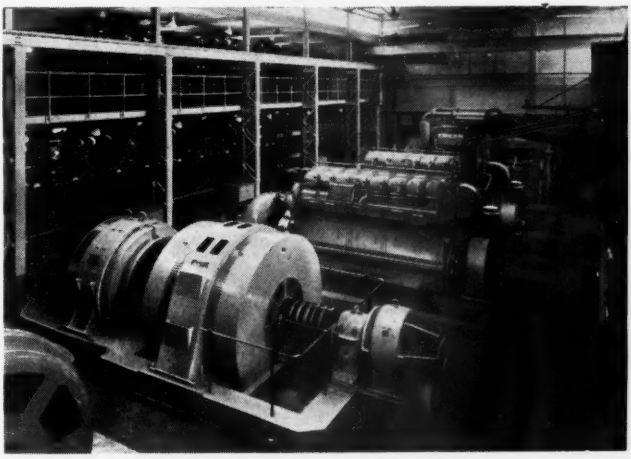
PROBABLY no industry presents such exacting demands with regard to electricity supply as does the film production industry. Loads may develop from virtually zero to many thousands of amperes in a matter of seconds and may be shed just as rapidly. Moreover, this may happen three or four times in a quarter of an hour and the position tends to become even worse with the increasing proportion of colour films now being made with their substantially higher demands for electricity. To achieve a load factor of above about 15 per cent is exceptional and 10 per cent is not unusual.

The nature of the load is therefore not one which has much to recommend it to Electricity Boards as meriting special concessions in regard to charges and a tariff based on maximum demand has a by no means insignificant effect on production costs. On the other hand, private generation has its own disadvantages. The widely fluctuating load renders a steam plant uneconomic while diesel sets require comparatively frequent overhaul and have therefore to be duplicated if production is not to be interfered with.

With the object of eliminating the main disadvantages of both public and private supplies, a combined system operating in tandem has just been completed at the British Lion Film Studios at Shepperton. In the summer period when the maximum demand tariff does not operate the public supply only will be used. From 1st October and throughout the winter six months the supply will be taken from diesel plant, and only when the load exceeds the capacity of the latter will the public supply be called into service.

When the British Lion Studio Co., Ltd., took over the studios some five years or so ago there were five diesel generating sets available providing a total of 1,600 kW, or 13,000–14,000 A at 120 V d.c. About 4,000–5,000 A was used for normal services on site and this load had to be shed whenever stage loads called for the full output of the station. As an interim measure, therefore, two Ruston & Hornsby reconditioned 6- and 8-cylinder diesel engines were installed direct-coupled to 305 kW and 415 kW Lancashire Dynamo & Crypto 120/0/120 V generators with mid-wire slip rings and static balancers.

When the new supply scheme was planned arrangements had to be made for shooting simultaneously two colour films plus a certain amount of black-and-white work, allowance also being made for the future construction of four new 250 ft stages in addition to the



General view of power house

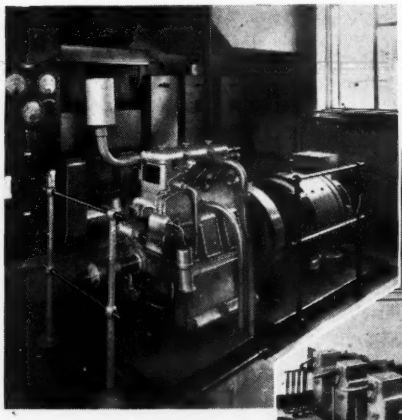
four existing stages. As large colour film sets can demand up to 24,000 A or more this seemed to indicate at first sight that a maximum power house capacity of about 75,000 A was required. However, the intermittent nature of the loads did not warrant such excessive capital outlay and it was finally decided that by proper production planning it was possible to reduce the maximum capacity to about 32,000 A.

Units of the old generating plant which were usable were incorporated in the new scheme, and arrangements were made to bring in an 11 kV feeder from the nearby grid line. The reconditioned diesels were used as the basis for the new power house which was constructed around them. Two further diesel sets were installed comprising Davey Paxman 750 h.p. high-speed 8-cylinder vertical engines fitted with exhaust turbo blowers and heat exchangers. Each of these engines drives an E.C.C. 500 kW 120/0/120 V d.c. generator, the mid-wire being taken out through slip rings and a static balancer. The flywheels are designed to smooth out cyclic irregularities to comply with a maximum ripple specification. These two machines bring the total diesel generating capacity up to 1,720 kW.

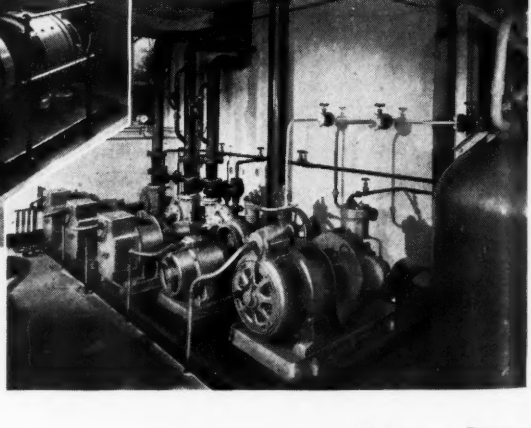
A further 2,000 kW is available from two motor-generator sets comprising 11 kV 1,450 h.p. synchronous-induction motors with overhung exciters, solidly coupled to 1,000 kW 120/0/120 V generators provided with mid-wire slip rings and static balancers. One of these machines is of G.E.C. manufacture and the other was made by the Metropolitan-Vickers Electrical Co.

Each of the diesel engines is provided with its own built-on Streamline lubricating oil filter (with 3 kW electric heater) and is arranged for compressed air starting. The main air compressor for this is a Hamworthy vertical single stage totally enclosed water cooled unit having a 15 cu ft/min displacement and driven by an E.C.C. 240 V 5 h.p. shunt wound screen protected d.c. motor. As a standby there is a 10 cu ft/min Ruston & Hornsby compressor driven by a 3½ h.p. 240 V d.c. motor. Both machines feed into two air bottles in parallel, each having a capacity of 23 cu ft at a pressure of 300 lb/sq in.

The four diesel sets require between them a maximum of 385 gal of cooling water per minute. The water is obtained from the River Ash, which runs through the property, via an intake box with wire mesh screens and through a 12in gravity pipe to a cold well. Three Ruston centrifugal pumps (driven by E.C.C. 5 h.p. 240 V d.c. motors) have been provided to take the water from the well to a 2,400 gal main storage tank, which is normally of sufficient capacity to provide for about 15 min operation. Each pump has its own automatic starter and arrangements are made by means of a rotary switch for any two to be used, one being float switch operated and the other push-



Above: The 17½ kW power house service diesel generator set



Right: Power house pump bay showing cooling water circulating pumps and compressors for air starting main diesel engines

Rear view of main power house generator control switchboard showing smoothing chokes and condensers

button controlled. In addition to the normal float switch which operates when one quarter of the water has been drawn off the storage tank a second float switch has been fitted to sound an alarm should the first switch fail.

In the event of failure of the external supplies a Ruston-Lister hand-started stand-by house diesel engine direct coupled to a 240 V 17½ kW d.c. generator can be brought into service to provide a limited house supply for charging compressed air bottles, etc.

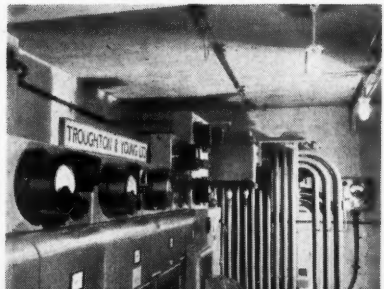
Fuel oil for the diesel engines is stored in three 7,000 gal vertical tanks mounted in a well outside the power house. A common feed pipe from the tanks goes through filters to two Plenty 150 gal per hour rotary displacement fuel pumps driven by 240 V ¾ h.p. a.c. motors. Each engine has its own daily service tank with two float switches at 75 and 50 per cent capacity—one for control and one for alarm.

In parallel with the d.c. windings of each magnetic valve controlling the flow of oil to the daily service tanks is a contactor which operates the pump starters. One of the pumps is arranged as stand-by, a selector switch making it possible to use either pump at will. A time lag relay shuts down the pumps if, owing to a sticking magnetic valve, pressure does not build up in the main header pipe to which the delivery pipes are connected and so avoids any risk of a spill-over. In the event of failure of the a.c. supply a semi-rotary quadruple action hand operated pump can be used to prime any of the tanks.

All failure alarms are arranged to operate a 240 V d.c. gong and at the same time illuminate the appropriate indicator on a large indicator panel. The signal system referred to later also illuminates indicators on this panel, the audible warning in this case being a Klaxon hooter.

To handle the 11 kV supply from the Southern Electricity Board a G.E.C. 5-unit 250 MVA oil and compound filled vertical isolation switchboard is installed. No. 1 unit controls the incoming supply, Nos. 2 and 3 units control the 11 kV supply to the site substations and Nos. 4 and 5 units control the 1,450 h.p. motors driving the 1,000 kW generators. The panel for the incoming supply is provided with ammeters, wattmeter, three-phase integrating watthour meters and maximum demand indicators with synchronous time elements, power factor indicator and three inverse time delay overcurrent relays with earth leakage features.

The two substations are equipped with B.E.T. 1,000 kVA 11 kV/440 V transformers



No. 1 substation: switchgear and transformer

and Crompton Parkinson " Klad A " switchboards to provide 240/415 V a.c. for general power, lighting, etc., and l.v. distribution is via an underground cable network feeding Enfield pavement type distribution pillars.

The motor-generators are started by G.E.C. motorized liquid starters which operate upon the closing of the h.v. breaker, the machines being designed to self-synchronize. Facilities for manual operation are also provided if required and the plant is shut down by push-button from the generator switchboard. The starters are fitted with short circuiting and interlocking contacts, the d.c. circuit breaker interlocking with the a.c. breaker to prevent motoring. Field and exciter controls together with duplicate instruments are provided on the generator control board.

The d.c. switchboard has main common busbars (16,000 A rating) to which all machines feed. Each generator is provided with a Brown Boveri automatic voltage regulator which not only maintains the output voltage constant to $\pm 0{\cdot}75$ V but is also fitted with a current sensitive element which effects automatic load sharing between machines. Satisfactorily stable conditions have been obtained with this equipment even during excessive load shedding. Equalizer controls and manual field regulators are also provided so that the station can be operated manually if required. Objectionable ripple is eliminated from the output of each generator by an air cooled choke (with laminated windings) inserted in series with each pole, while banks of condensers (30,000–50,000 μF per bank) are connected across the outputs.

From a house service panel at the extreme end of the generator board supplies are taken for the station auxiliaries and also for various generator rooms, sewer pumps and other essential services on the site. The 17·5 kW set also supplies this panel. To keep essential d.c. services going at night without running the main plant and also to provide an alternative supply for the power station auxiliaries two Hewittic mercury glass bulb rectifiers (50 kW and 100 kW) operate on a 2 kV single-phase supply independently of the 11 kV supply and also feed into the house service panel. The incoming 2 kV supply is fed through a main isolating circuit breaker to a Ferranti moving coil, motor operated, oil filled voltage regulator whence it passes via a manual isolating link box to the rectifier transformers.

This article will be concluded in a later issue with a description of the distribution arrangements.

Streatham Hill Theatre

THE re-opening on Boxing Day of the Streatham Hill Theatre after being out of service for six years, due to damage by a flying bomb, has involved complete re-wiring and overhauling of the electrical equipment, together with the provision of additional apparatus. The stage lighting equipment has been renovated and the eight-position pre-set switchboard has been raised from stage level to a gallery 12ft above, thus making additional floor space available.

A twelve-way panel has been added to the stage switchboard to control a bank of six pageant spotlights mounted under the dress circle and new footlights have been installed. The front-of-house spotting arcs have been increased by the addition of two sun arcs. The secondary lighting installation has been overhauled and the existing battery was replated by the Chloride Electrical Storage Co., Ltd.

The intercommunication telephone installation was overhauled by Standard Telephones & Cables, Ltd., while Tannoy, Ltd., was responsible for installing a new public address system. The electrical equipment in connection with the heating and ventilation installation was overhauled by Jeffreys, Ltd. The renovation and supply of renewals for the stage lighting equipment was carried out by Strand Electric & Engineering Co., Ltd. The whole of the foregoing works were undertaken by the main electrical contractors, Barlow & Young, Ltd.

Electrical Specifications

How Much or How Little Detail?

By F. GEOFFREY MARSHALL, A.M.I.E.E.

WHEN electrical specifications are being prepared for new installations it is necessary to give careful thought with regard to what is to be included, and what omitted. Sufficient information has to be provided to ensure that the contract is completed to the engineer's satisfaction, but a large amount of useless wording can be eliminated by reference to an appropriate I.E.E. code or British Standard Specification.

Broadly speaking, a specification fulfils three main purposes :—It enables the installations to be provided on good sound engineering lines, in accordance not only with general practice, but also with the special individual preferences of the engineer concerned ; it ensures that, when a number of firms are invited to quote, they are tendering along similar lines, so that a fair comparison can be made ; and, if properly prepared, it cuts down possible later claims for extra payments to the minimum, thereby enabling an accurate estimate of the total cost of an installation to be made at an early date.

Reducing Bulk

It often happens that, when the number of different specifications that have to be prepared over a period of years is large, the essence of each specification consists of the main body of an earlier one, altered to suit the special requirements of the particular installation then being planned. If such a practice is pursued, great care must be taken that the specification does not become too bulky, and it should be carefully pruned on each occasion, all unnecessary wording omitted, and all possible contradictions eliminated.

Dealing with the portion of the specification covering special items, such as wiring, it will often be found sufficient to stipulate that this shall be carried out to the appropriate Standard Specification. Where, as is especially the case with large concerns, the engineer wishes to go further, and mentions his special detailed requirements, which may be peculiar to his own organization, he can either issue his own printed wiring specification on a separate sheet, at the same time making reference to it in each specification he produces, or he can quote the standard and then proceed to mention specifically the points on which he desires the tender to diverge from that standard. By this means the bulk of the specification can often be reduced considerably, and useless repetition avoided.

Possible Alternatives

A common complaint that is heard when dealing with the very long and minutely detailed specification is that it eliminates free enterprise on the tenderer's part, and cuts out all possibility of new ideas being put forward. This may be true in some cases, but it can be easily got over by allowing tenderers, providing they also quote in accordance with the specification, to put forward alternatives, at the same time giving details of any price variation which would be necessary if these alternatives were accepted. By this means the engineer, while still obtaining competitive tenders to his detailed requirements, is nevertheless in a position to take advantage of any special suggestions or innovations.

Another question that has several perplexing features is met with when deciding in what degree the engineer should name specifically the makers of components. A specification can, for example, lay down that all cables should be of C.M.A. manufacture, but should it stipulate the actual name of a maker ? This seems to be purely a matter of circumstance. In the case of cables, having once mentioned the C.M.A. grade, it would appear superfluous to demand that they should be provided by an individual maker.

On the other hand with equipment such as, for example, switchgear, the position is very different. Probably the engineer has already standardized all fusegear installed in

the factory, or, if an entirely new works is being considered, then he may wish, quite justifiably, to use a certain make the reliability and efficiency of which he has had ample proof and experience. Once again though, if there are any doubts in the engineer's mind and if he wishes to make any comparisons, he can include in his specifications permission to put forward equipment of different manufacture, provided it is quoted as an alternative.

It should be realized that, in examining a number of detailed electrical tenders, the engineer can obtain valuable experience, especially if the original specification is worded so as to allow the tenderer to put forward his own ideas and suggestions.

The question of the degree of detail to be entered into in an electrical specification is largely a matter of opinion and of the internal organization of the engineer issuing it. When he has a large electrical staff it is often preferable to describe requirements minutely. In the clause of a specification dealing with lighting, for example, in cases such as this, the exact position, type, and wattage of every lamp may be shown with an accompanying detailed switching diagram, but in other cases it may be considered sufficient to state that the lighting is to be carried out to provide a certain minimum value in foot-candles.

In all specifications there are certain clauses on general conditions of contract and certain other routine matters that have to be mentioned when all inquiries are sent out. It is advantageous to all concerned to treat these entirely separately, merely referring to them in the main specification. This procedure also assists those firms being invited to submit tenders, as the technical portion of the specification may have to be split up for submission to various departments.

Summarizing, it may be said that the specification can be as detailed and as rigid as the engineer wishes, but where possible alternative suggestions or schemes should not be barred. In addition, Standard Specifications and regulations should be used as fully as possible to prevent too bulky specifications.

Notes for Contractors

Distribution Census : Category III Labour

THE director of the Electrical Contractors' Association (Mr. L. C. Penwill) has given his members guidance in the matter of the 1950 Census of Distribution. He says that the Board of Trade has agreed that electrical contractors with no shop premises or other retail outlets and whose "over the counter" retail sales are of a minor nature need not complete a return. This also applies to those contractors who have a showroom for the prime purpose of enabling customers to select fittings, etc., which form part of an installation contract, unless retail sales dissociated from their electrical contracting activities are made from such premises in some volume.

Electrical contractor-retailers trading from retail premises or with other retail outlets will be required to make a return. Generally speaking, where their accounts do not differentiate between contracting and retailing activities they should include figures relating to both sides of their business. If, however, in such circumstances the retailing and contracting businesses are carried on from different premises the facts should be reported to the Board of Trade. Where separate accounts of the two sections are available only particulars of the retail side are required.

At a recent meeting of the National Joint Industrial Council for the Electrical Contracting Industry the Electrical Trades Union representatives put forward a motion proposing that the National Federated Electrical Association should "educate" its members against the employment of Category III lads (youths under 21 whose employment can be terminated at any time subject to the usual notice). The motion also included an undertaking by the E.T.U. to check the current demand of operatives that they should always be accompanied by a mate even where this was unnecessary. The N.J.I.C. was asked to fix a date after which no further Category III labour would be engaged in the industry and to lay down a ratio of one apprentice to five journeymen.

The official journal of the E.T.U. says that failure to agree was recorded although the N.F.E.A. acquiesced in the first two proposals. It considered that the abolition of Category III labour should await the results of the educational work of both sides.

Nevertheless the E.T.U. has urged its members to cease to demand that they should be accompanied by mates in all circumstances. It is considered that this will hasten the abolition of Category III labour.

Grid Control Centre

Temporary Move to Paternoster Square, London

As most readers know, the grid system consists mainly of 132 kV overhead transmission lines connecting the generating stations and main grid substations in England, Wales and South Scotland. There is a small mileage of 132 kV underground cable, mostly at line terminations and in the London area, where there is also an extensive 66 kV underground cable network. The fourteen Electricity Boards take and distribute bulk supplies from the grid which is operated by the British Electricity Authority.

The whole grid operates as an interconnected system and its control is carried out from eight area centres at Glasgow, Newcastle, Manchester, Leeds, Birmingham, London (2) and Bristol. Each is responsible for the operation of the lines, substations and associated generating stations in the area concerned. There is also a National Control Centre which exercises an overriding control over the area centres and carries the responsibility for general security of supplies, economic transfers of energy between areas, system frequency and electric time.

The National Control Centre and one of the two London control centres were, until recently, in the former C.E.B. control centre in Newgate Street, the other London control centre being in the former London Power Co. building, Westminster. Because of congestion and obsolescence of equipment, it has become essential for the control centres to be moved and, as a permanent building is not yet available, temporary accommodation has been built in Paternoster Square.

National Control in London has no concern with the operation of individual generating stations or grid equipment; it co-ordinates interconnected operation through the area control centres.

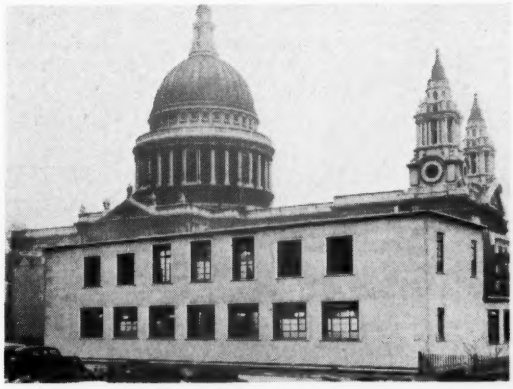
Within the limits of security and tie-line capacity, operation of the grid is on an economic basis, and one of the main functions of National Control is to arrange transfers of energy between areas to obtain the maximum use of high-merit generating plant.

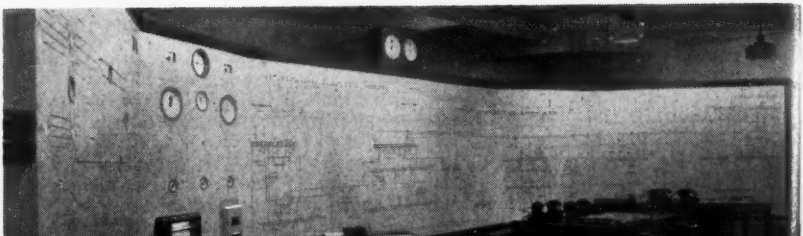
Inter-area transfer programmes are arranged in advance each week in the light of the latest information on plant availability, relative generating costs and expected demands in each of the areas. The programmes are reviewed, and if necessary revised, at regular intervals each day to take account of actual conditions. Another of the responsibilities of National Control is the co-ordination of main transmission line and generating plant maintenance programmes.

At present an important function of National Control is the sending out of load shedding instructions to the areas, which are timed to prevent the frequency falling below 48 c/s. Communication with the area control centres is by Post Office teleprinters so that a record of all messages is preserved.

The information required by National

Exterior of the temporary Control Centre, Paternoster Square

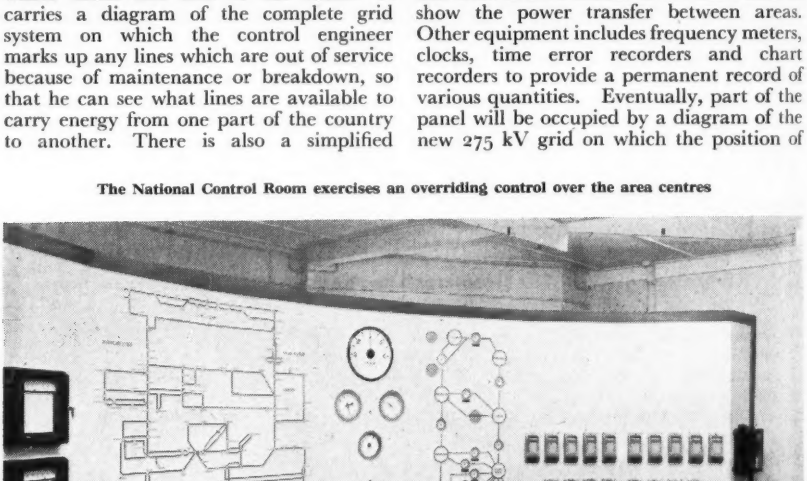




In the Thames South Control Room the loading and switching diagrams are in one continuous line

Control is displayed on a curved panel which forms one side of the room. It carries a diagram of the complete grid system on which the control engineer marks up any lines which are out of service because of maintenance or breakdown, so that he can see what lines are available to carry energy from one part of the country to another. There is also a simplified diagram showing the inter-area lines only but with meters mounted on each line to show the power transfer between areas. Other equipment includes frequency meters, clocks, time error recorders and chart recorders to provide a permanent record of various quantities. Eventually, part of the panel will be occupied by a diagram of the new 275 kV grid on which the position of

The National Control Room exercises an overriding control over the area centres



each circuit breaker will be indicated automatically.

When the control centres were moved to Paternoster Square the opportunity was taken to rearrange the original control areas into two more nearly matched parts so that the most efficient use could be made of the existing equipment and staff. The area covered is known as the Thames Control Area and stretches from the Wash to Littlehampton on the south coast. The dividing line between the north and south of the area follows mainly the route of the Thames. Each area control centre is connected with National Control by teleprinter and separate operating instructions are received by this means. Each control centre has private telephone lines direct to each generating station and grid substation in its area.

Switching and Loading

The two main functions of the grid control engineer are switching grid circuits and loading generating stations. This is carried out with the aid of diagrams and instruments suitably arranged in relation to the control desks. The switching diagrams show every circuit and item of equipment over which the engineers have direct control. No direct switching is carried out from the control rooms; telephoned instructions are used exclusively. All switching is done in accordance with the B.E.A. safety rules under a very complete " permit-to-work " system, the final arbiter in all cases being the control engineer.

The loading diagrams show the grid system in outline and, for simplicity in operation, instruments indicating the power flow in the lines and other important information are incorporated. Each loading desk is provided with a " routine instructor " instrument by means of which instructions can be sent out to the more important generating stations. These instructions cover the picking-up or dropping-off of varying amounts of generation or the shedding of load. Contact with stations not connected to the instrument is maintained by telephone.

In each area control room is a reproduction of the National Control diagram which is kept dressed from information received over the teleprinter service. The area control engineers are thereby aware of conditions elsewhere in the country which may affect their own operation. Each of the miniature National Control diagrams has a background of metal-faced plywood and small permanent magnets are used for indicating line outage conditions.

The principal differences between the layouts of the two control rooms are that in Thames North the loading and switching diagrams are placed at opposite ends of the room. This makes for quietness when a number of telephone calls are in progress, but has the disadvantage that the switching engineers have their backs to the loading diagram, to which they may wish to refer from time to time. This disadvantage has been overcome in the Thames South control room by placing the loading and switching diagrams in one continuous line.

In Thames South the switching diagram is a temporary one of plywood with plastic discs representing switch and isolator positions. The circuits are represented by coloured adhesive tape; similar tapes are also used for the loading diagrams in both control rooms.

In Thames North the switching diagram has been brought from the previous control centre and re-erected. It comprises about 40,000 one-inch squares of plastic material mounted on vertical steel strips 6in wide with a choice of different symbols engraved on the squares and suitably coloured. Provision is made for fixing labels to indicate the presence of earths on apparatus under maintenance. Labels are also used to show apparatus covered by " permit-to-work " cards and to signify special requirements.

Household Refrigerators

TWO standard specifications just issued prescribe the general constructional requirements for electric refrigerators, not exceeding 12 cu ft net volume, designed for household use. Methods of determining performance and of computing volume and shelf area are included, with definitions of some of the terms employed; household food freezers are also specified in both cases.

The two documents differ only in respect of temperature and test pressure ranges: B.S.1691 is concerned with machines for use in temperate climates only; it is complementary to, and based on, B.S.922, which deals with machines for use in all climates. When the latter was first published in 1940 it was largely based on the American, Australian and Canadian codes. Copies are obtainable from the British Standards Institution, 24, Victoria Street, London, S.W.1, price 3s, post free.

SOUTH AFRICAN NEWS

From Our Cape Town Correspondent

AFTER fifteen years, the reserves of coal at the Electricity Supply Commission's Klip power station, once estimated to be sufficient for 100 years, are nearly exhausted, but other coal deposits at the Grootvlei Colliery, about 40 miles away, are said to be sufficient for 300 years. The Commission is already drawing a large proportion of its power station requirements from this colliery and, as a result, there is little likelihood of any disruption of the Rand's mining and industrial power network. A possible effect, however, may be an increase in the cost of power to consumers; a new tariff may be introduced some time in 1951. Up to the present coal used at Klip has cost 4s 7d a ton, but it will cost more from Grootvlei. Rail tariffs are now the subject of negotiation between the Commission and the railways and when fixed are likely to affect industrial costs.

Cable Production and Export

The chairman of African Cables reports that last year's production exceeded all previous records. Orders are sufficient to ensure a steadily expanding output during the current financial year. The company has been building up stocks of raw materials, most of which are imported. Of the profit of £234,432, the reserve for taxation was £69,000, and £100,000 was added to reserves, and only £58,500 used to pay the usual dividend of 3s per share.

Export orders are absorbing approximately 40 per cent of the local output of electric cables, for which the demand remains strong and rates of production steady. The manufacturers state that they continue to receive satisfactory supplies of raw materials.

The Vereeniging factory of Babcock & Wilcox of Africa (Pty.), Ltd., will probably make much of the power station equipment needed in the Union in the future. This £500,000 project occupies a 46-acre site at Duncanville Industrial Township. It is now expected that the factory will begin production towards the latter part of 1951. Present plans provide for the manufacture there of a number of the requirements of power stations such as water tube boilers, mechanical stokers, electric cranes, conveyors, coal pulverizing equipment, etc.

The company is to supply plant to the Electricity Supply Commission for major extensions to the Vaal, Colenso, Congella and Witbank power stations and for equipping the four new power stations named Taaibos, Salt River No. 2, Hex River and Westbank No. 2. The Taaibos station has been planned to provide more power in the Orange Free State. It will be in the north of this province near Coalbrook Colliery. Initially it will consist of two boilers with a capacity of 580,000lb/hr and two 60,000 kW turbo-alternators. Both boilers and turbo-generators will be the largest ever to be installed in the Union. Railways are building a special truck to carry them. During 1949 contracts worth £2,173,824 were placed overseas in connection with the initial installation at Salt River No. 2 station at Cape Town. This plant will include one 30,000 kW turbo-alternator, 260,000lb/hr boilers, and ancillary plant, all to be ready by the middle of 1954. Later on the capacity will be increased by a second 30,000 kW set and two boilers, to be in service in 1955. Work is being pressed ahead with the new Hex River power station at Worcester. This is to have five 20,000 kW turbo-alternators and seven 200,000lb/hr boilers. At East London the Westbank No. 2 station is initially to consist of two 170,000lb/hr boilers and two 15,000 kW turbo-alternators.

Lamp Testing

Methods of testing tungsten filament lamps are included in the Bureau of Standards specification, which covers the dimensional and performance requirements. The fact that screw caps and holders and reflector type fittings designed to both British and American standards are being used in South Africa has been recognized, and dimensions for both types are given in the specification. Lamps manufactured with British or American light centre lengths are also covered by the specification, which includes definitions, physical requirements, marking, and methods of sampling and test.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AT a meeting of the Association of Electrical Undertakings, Bombay Province, last month **Mr. V. F. Noel Paton,** president, announced that he was retiring from India in April. The members placed on record their appreciation of Mr. Noel Paton's services as president since the inception of the Association in 1940. Mr. Noel Paton is also president of the Federation of Electricity Undertakings of India.

Mr. B. Wilkinson, B.E., A.M.I.E.(Aust.), has been appointed managing director of Electronic Tubes, Ltd. Previously Mr. Wilkinson was commercial director of E.M.I. Factories, Ltd., which he joined in 1946. Although relinquishing the duties of commercial director, Mr. Wilkinson retains his seat on the board of E.M.I. Factories, Ltd. Before coming to this country he was with Amalgamated Wireless Australasia, Ltd., for sixteen years. During the last war he was in charge of the Marine Engineering Department of his company.

Mr. B. Wilkinson

Mr. A. W. Reading, A.M.I.E.E., has recently been appointed to the London sales office staff of Lancashire Dynamo & Crypto, Ltd. He joined the company in 1938, and in 1939 joined the army, saw service overseas and won the M.C. He returned to the Willesden Works in 1947.

Mr. J. Stewart has been appointed branch manager, Glasgow, of Falk, Stadelmann & Co., Ltd., in succession to the late Mr. C. J. B. Clegg, whose death is reported in our obituary section.

The New London Electron Works, Ltd., announces that **Mr. F. L. Levy,** who has for many years served on the board, has been elected chairman and managing director of the company. Mr. Levy is a director of the parent company of the "600" Group, George Cohen, Sons & Co., Ltd., and of its subsidiaries. He was recently elected to the board of an associated company, Batchelor Robinson & Co., Ltd. **Mr. W. Clarke,** general manager of the New London Electron Works since 1943, has been elected to the board.

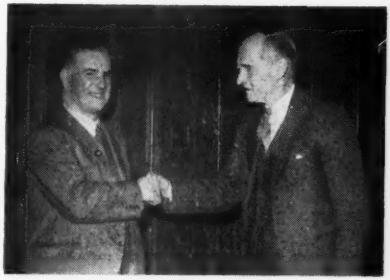
Dr. W. Snellen, director of the North Holland Electric Power Co., Bloemendaal, who is well known to the electrical industry in this country, retired on 31st December last.

The British Standards Institution has appointed **Mr. H. A. R. Binney,** C.B., to be its new director and secretary in succession to the late Mr. Percy Good, C.B.E. Mr. Binney joined the B.S.I. in September last as deputy director, and was previously an undersecretary at the Board of Trade.

Mr. R. J. Lewis has been appointed a director of Kerry's (Great Britain), Ltd. He joined the company (then East London Rubber Co., Ltd.), in 1934, and was manager of the Croydon branch for sixteen years. Since March, 1950, he has been in charge of branch administration.

Mr. J. Dowsett, district executive officer of the Southern Electricity Board at Maidenhead, has recently completed fifty years' service in the electricity supply industry. He was apprenticed to the Windsor generating station in 1900, later becoming station superintendent. He served in the 1914-18 war, was decorated for gallantry at Passchendaele, was twice wounded, and gained a commission in the Tank Corps. On returning to civilian life he became assistant engineer at Maidenhead and later deputy borough elec-

Mr. J. Dowsett (left) being congratulated by Mr. H. Nimmo on completion of fifty years' service in the electricity supply industry



trical engineer which position he held until nationalization when he was appointed district executive officer. In the accompanying picture Mr. Dowsett is being congratulated by Mr. H. Nimmo, chairman of the S.E.B.

Mr. J. K. Clark, B.Eng., A.M.I.E.E., A.M.I.Mech.E., has been appointed chief engineer of the Electro Chemical Engineering Co., Ltd., Weybridge, Surrey.

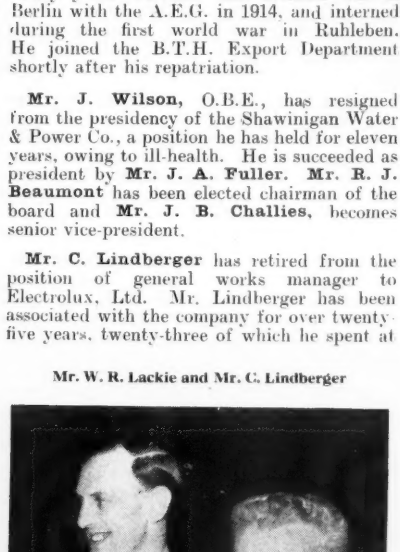
Mr. A. J. Leather, A.M.I.E.E., who is at present with the Yorkshire Electricity Board, is taking up the position of district engineer, Shrewsbury, Midlands Electricity Board. Mr. Leather was formerly with the Wigan Corporation undertaking.

Mr. J. H. M. Nichols, B.Sc., who has been associated with many export contracts for turbine plant, retired on 31st December from the Turbine Sales Department of the British Thomson-Houston Co. after just over thirty years' service. Mr. Nichols was in Berlin with the A.E.G. in 1914, and interned during the first world war in Ruhleben. He joined the B.T.H. Export Department shortly after his repatriation.

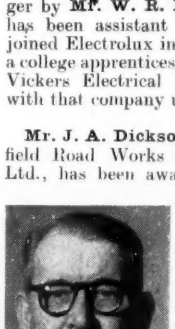
Mr. J. Wilson, O.B.E., has resigned from the presidency of the Shawinigan Water & Power Co., a position he has held for eleven years, owing to ill-health. He is succeeded as president by **Mr. J. A. Fuller. Mr. R. J. Beaumont** has been elected chairman of the board and **Mr. J. B. Challies,** becomes senior vice-president.

Mr. C. Lindberger has retired from the position of general works manager to Electrolux, Ltd. Mr. Lindberger has been associated with the company for over twenty-five years, twenty-three of which he spent at the Luton works. He is not entirely severing his connection with the company as he is remaining in a consultative capacity for the time being. He is succeeded as works manager by **Mr. W. R. Lackie,** A.M.I.E.E., who has been assistant works manager since he joined Electrolux in 1947. Mr. Lackie served a college apprenticeship with the Metropolitan-Vickers Electrical Co., Ltd., and remained with that company until he joined Electrolux.

Mr. W. R. Lackie and Mr. C. Lindberger



Mr. J. A. Dickson, manager of the Springfield Road Works of the Gramophone Co., Ltd., has been awarded the M.B.E. in the New Year Honours and we reproduce his portrait together with that of **Mr. L. Rushforth,** M.I.E.E., head of section, B.T.H. Research Laboratory, Rugby, who, as we mentioned in our last issue, also becomes an M.B.E. In addition to those already mentioned, the O.B.E.s include **Mr. A. R. Driessen,** Eastern Area branch manager, British Insulated Callender's Cables, Ltd.



Mr. J. A. Dickson

Mr. L. Rushforth

Mr. John J. Scrivener was on 29th December presented by the directors of the British Thomson-Houston Co. with an armchair and settee inscribed to mark the completion of 50 years' service. Mr. Scrivener, who will be 79 in February, was in charge of the Wiring Department from 1909 until 1934, since which date he has been head of the employees' sales counter. During his fifty years Mr. Scrivener has been active in a number of social and other directions.

Hoover, Ltd., announce that as from 1st January certain of their directors and executives have assumed new responsibilities. The changes are as follows : **Mr. A. G. Colston** from technical service manager and director, Hoover (Washing Machines), Ltd., to technical sales manager and director, Hoover (Electric Motors), Ltd. Mr. Colston will assume control of the sale of f.h.p. motors in addition to continuing to direct the servicing of all Hoover products. **Mr. C. H. Crowlie** from sales manager, Great Britain, and director, Hoover (Electric Motors), Ltd., to

export sales manager and director, Hoover (Washing Machines), Ltd. **Mr. S. Roberts,** a director of Hoover (Washing Machines), Ltd., from field sales manager to home sales manager, in which post he will be responsible for all departments of the Hoover sales-service organization in Great Britain and Ireland, except those of technical sales manager. **Mr. G. J. Hemmings** from northern sales manager to field sales manager, Great Britain. **Mr. J. B. Rogerson** from assistant technical service manager to technical service manager. **Mr. H. G. Hulme** from Scottish branch manager and assistant northern divisional manager, with headquarters at Glasgow, to northern sales manager, with headquarters at Leeds. Mr. Hulme's successor has not yet been appointed.

Mr. H. L. Satchell, M.B.E., director and manager, Rugby Works, British Thomson-Houston Co., has been elected president of the Engineering and Allied Employers' Leicester and District Association. Mr. Satchell has been a member of the Association for about fifteen years and last year was vice-president.

The Minister of Fuel and Power has appointed **Mr. E. H. Hickery,** B.A., of Risca, Mon., to be a part-time member of the South Wales Electricity Board. The vacancy arises from the resignation of Councillor I. R. Thomas from the Board last year.

Mr. Edwin Dadswell recently retired from the position of mechanical superintendent of the Keighley undertaking, Yorkshire Electricity Board, after 38 years' service. Following his apprenticeship with the Central Marine Engine Works, West Hartlepool, Mr. Dadswell spent seven years at sea and joined the Keighley Electricity Department in 1912. At a recent gathering he was presented with a golf bag and accessories by Mr. O. G. Cook, district manager, on behalf of the staff and employees.

Mr. J. Jex-Long, of Hebburn-on-Tyne, who has retired from the post of works manager of the Hebburn New Town Works of A. Reyrolle & Co., Ltd., has been presented with a wrist watch, fishing tackle and silver cigarette case by members of the staff. Mr. Jex-Long joined A. Reyrolle & Co. thirty years ago from A. Watson & Co., Ltd., Glasgow.

Mr. H. Jinks, an employee of William McGeoch & Co., Ltd., has retired at the age of eighty-one after sixty-two years' service. A presentation was made to him on 22nd December in the works canteen by Mr. W. P. McGeoch, the works managing director.

Mr. W. H. T. Parr, M.I.E.E., D.F.H., has been appointed executive engineer on the Snowy Mountains Hydro-Electric Authority and will be sailing for Sydney on the s.s. *Maloja* on 17th January. Mr. Parr was previously manager of the Birmingham office of Messrs. Highfield & Roger Smith and has been associated with the firm for the last fifteen years.

Mr. Frank Gowdridge, who in 1926 joined the old Leicestershire and Warwickshire Electric Power Co., later becoming district engineer and subsequently district engineer for the Kibworth (Leics.) district of the East Midlands Electricity Board, has been appointed manager of the Coalville district. At the recent annual dinner of the Kibworth district staff a presentation was made to Mr. Gowdridge by the staff.

Mr. T. J. Lewis, B.Sc.(Eng.), Ph.D., has been elected to the W.T. Henley Fellowship at Queen Mary College, University of London, for electrical engineering research.

At a meeting of the staff of **Edward A. Pearce & Partners,** consulting engineers, at Harrow, on 22nd December, Mr. E. A. Pearce stated that the staff pension scheme was now properly established. He announced the commencement of a profit sharing system in which all established staff of whatever grade would participate by means of the allocation of units. The scheme was to commence immediately and first payments, to be made in June, would be based on the work of the current year ending next April.

The directors of the **Telegraph Construction & Maintenance Co., Ltd.,** entertained their head office staff at an informal Christmas luncheon on 20th December at the Palmerston Restaurant, Bishopsgate. Mr. J. N. Dean, managing director, presided and thirty members of the staff were present. Mr. G. L. Lawford, secretary of the company, thanked the directors for their hospitality, and Mr. J. N. Dean replied on behalf of the directors. Other directors present were Mr. B. H. Musgrave, Mr. W. F. Randall and Dr. E. W. Smith (director of Submarine Cables, Ltd.) and the works manager, Mr. F. Leighton.

The annual Christmas dance of **Venner Time Switches, Ltd.,** was held on 15th December. Fancy dress was worn by many and prizes were awarded for costumes. On the following afternoon the children's annual Christmas party took place when some 240 children were entertained to tea and a film show. Every guest received presents.

Before the commencement of the Sunco Social and Sports Club's Christmas party, the directors of the **Sun Electrical Co., Ltd.,** presented gold watches to twenty-three members of the staff having more than twenty-five years' service. The presentations were made by the joint managing directors, Mr. E. J. Beaver and Mr. R. J. Rawlings. Longest service was that of Mr. A. G. Owen

(director responsible for the installation accessories side of the company's business), with forty-four years, followed by Miss V. M. Cresswell with thirty-six years. Among others who received watches was Mr. R. J. Willis, M.I.A.M.A., publicity manager.

Staff of the **Hoover (Washing Machines), Ltd.** factory at Merthyr Tydfil, Wales, produced their own pantomime "Cinderella" recently. This was the first venture of the Social Club's concert section. It was played in the restaurant at the factory on three occasions and later at the Coliseum, Aberdare. Major F. E. Crago, safety and training officer, produced and took part in the pantomime.

The **Portland Players** (B.E.A. Headquarters Sports and Social Club) are presenting "See How They Run," a farce by Philip King, at Portland Hall, Little Tichfield Street, London, W.1, on 18th and 19th January.

The **British Electricity Authority** is inviting applications for the posts of divisional controllers in the East Midlands Division with headquarters at Nottingham (where a vacancy will occur in the near future) and in the London Division (where the position will become vacant at the end of 1951). The salary range for these appointments is £2,500 to £3,250 per annum (London £3,500 per annum). The positions are advertised in this issue.

OBITUARY

Mr. J. A. Sweetlove.—The death has occurred at the age of fifty-two of Mr. James A. Sweetlove, senior electrical engineer for ten years with Imperial Chemical Industries, Ltd. He was responsible for electrification projects at the I.C.I. works at Billingham.

Mr. J. E. Peover.—The death occurred on Christmas Day at the age of forty-nine of Mr. J. E. Peover, superintendent of electrical erection with the English Electric Co., Ltd. Mr. Peover joined the company as an apprentice in 1917. He travelled extensively for the company, particularly in France, South Africa and Poland. During the war Mr. Peover was sent to Malta for the installation of the underground power station and rectifier substation at the Naval Dockyards. He also supervised the erection of the largest rectifier installation ever built in this country—that of the British Aluminium Co. at Port Tennant, Swansea. He was placed in charge of the Outside Department, Stafford, in 1944. In 1945 he was appointed works manager of the plant and transformer works, but in 1947, owing to failing health, he returned to the Outside Department.

The late Mr. J. E. Peover

Mr. J. F. Simpson.—The death, at St. Annes on 1st January, is reported of Mr. Joseph F. Simpson, M.I.E.E., former borough electrical engineer of Preston. Mr. Simpson joined Preston Corporation in 1904 as assistant tramway engineer and manager and became borough electrical engineer in 1905. When the Preston undertaking was acquired by the Corporation in 1922, Mr. Simpson took charge and he was responsible for the erection of the Ribble power station. He retired in 1934. He was educated at the Manchester College of Technology and apprenticed to the Manchester Edison Swan Co. Before going to Preston he was associated with his brother in the firm of Simpson Bros., Hopton, and a Wigan firm of overhead line equipment manufacturers.

Major G. C. Milnes.—Another former municipal engineer's death is reported. Major George Clement Milnes, M.C., M.I.E.E., A.M.I.Mech.E., who was city electrical engineer of Lancaster from 1910 to 1948 (when he retired), died on 2nd January. Major Milnes was trained at the Sandycroft Foundry & Engineering Co.'s works and before going to Lancaster in 1905 was an assistant engineer with Taylor & Williams, civil engineers, Chester. In the 1914-18 war he served with the Royal Lancaster Regiment and the R.A.F. He was sixty-six years of age.

Mr. A. C. Low.—The death occurred in London on 4th January of Mr. Alexander Collie Low, C.B.E., secretary of the Engineering and Allied Employers' National Federation.

Mr. C. S. Davies.—The death recently occurred at Weston-super-Mare of Mr. Cyril Stuart Davies, managing director of Paxtons (Cardiff), Ltd., with whom he had been for over thirty years.

Mr. R. C. Brookes.—Mr. Ralph Caldecott Brookes, B.A., A.M.I.E.E., lecturer in electrical engineering at Liverpool University since 1920, died on 4th January, at the age of fifty-eight.

Mr. C. J. B. Clegg.—The death occurred on 31st December of Mr. C. J. B. Clegg, director and also branch manager of Falk, Stadelmann & Co., Ltd., Glasgow. Mr. Clegg had been branch manager since 1914, a local director of the company since 1919 and a full director since 1943.

Sir John Greenly.—The funeral of Sir John Greenly took place at Titley Church, Herefordshire, on Monday last. A memorial service is to be held on 18th January (at noon) at St. Martin-in-the-Fields.

VIEWS on the NEWS

By REFLECTOR

IN an article explaining the work of the South Eastern Electricity Consultative Council the *Evening Argus* (Brighton) quotes the case of a consumer who considered that a power plug in his bathroom was in a dangerous position. He asked the Electricity Board to have it removed. A man called, "undid four screws, moved the plug and fitted it in the hall. The job took only a few minutes, but a bill for 10s 6d was sent in." The consumer complained to the Consultative Council and the charge was subsequently halved. Now I consider this a remarkable piece of work to have been done in a few minutes, even with surface wiring, and the original charge was surely not excessive.

* * *

A recent letter to the *Manchester Guardian* advocated the use of closed stoves burning low-grade fuel as a means of solving the electricity-cut problem. Another correspondent says that he has already installed two of these stoves and has been awaiting fuel for them for some weeks. He considers that he is now worse off than if he had stuck to electric fires.

* * *

I cannot believe that the B.E.A. intends to do what the *Evening Times* (Glasgow) says it is going to do. This newspaper states that when the new Braehead (Renfrew) station goes into service about 120,000 tons of ash a year will be dumped into the Clyde. "It would seem as though the Clyde dredgers are going to have to work overtime once the Braehead station starts generating—unless the ash obligingly floats down to the Firth."

* * *

Several people have told me that they cannot believe that the cost of electricity to the domestic consumer has fallen since 1939. The 1949–50 B.E.A. Report said that the average price of 1·515d per kWh for "domestic, commercial and small power" consumers was 5·1 per cent below the pre-war average and there are statistics to back this claim. It is a fact that not all consumers have benefited from this general reduction; I, for instance, have certainly not. First, the summer-winter "differential" was abolished, the winter rate becoming the standard; then my standing charge was raised; and, finally, a 10 per cent surcharge was added to the "unit" rate. Strangely enough I am not aggrieved for I was probably paying too little before and I consider the service to be reasonably priced now. But I cannot expect others to share my view.

* * *

From as far away as Hastings-on-Hudson, New York, comes an echo from a note I included in the 27th October issue—about permitting smoking in factories. My correspondent ("L.F.R." he wishes to sign himself) says that a side-light from a progressive New York plant manufacturing electrical equipment may be of interest. Fully knowing that the signs "No Smoking" drive the men, for indeterminate periods, into the men's rooms (locker rooms, toilets) and the girls into the ladies' lounges, the management of the company has reversed this policy. Smoking is permitted in all save a few hazardous work areas but strictly forbidden in the above-named localities. Both management and workers are satisfied with this arrangement.

* * *

From the *Irish News* (Belfast):—

> "Newry Urban Council accepted a tender of £1,444 for the lighting of the Northern Ireland Housing Trust estate at Rooney's Meadow by the most modern fluorescent electricity."

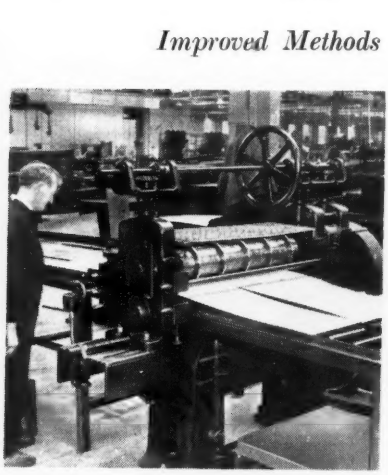
This is much to be preferred to the colourless old-fashioned sort.

* * *

Regarding last week's note on the "Round Britain Quiz," it has been pointed out that the equation should have been "A equals V divided by R." This is true and I regret the slip.

Domestic Appliance Manufacture

Improved Methods at the Elexcel Factory



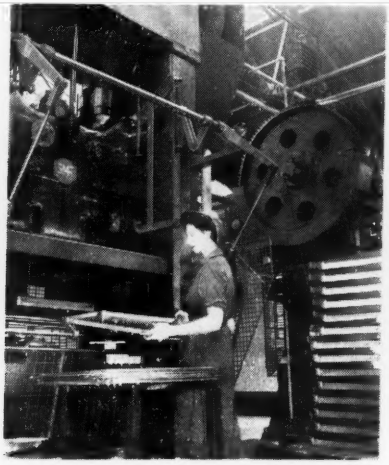
Considerable labour is saved by using rotary shears instead of guillotines to cut up sheet steel

Below, Left : A 300-ton press enables large pressings to be made in a single operation

Below, Right : Surface grinding solid hotplates

SINCE the war the domestic electrical appliance factory of Elexcel, Ltd., at Broad Green, Liverpool, has been increased in floor area by half and its layout has been completely reorganized. As a further means of increasing output and at the same time improving the already high quality of its products, the opportunity has been taken to replace a large proportion of the production equipment by more up-to-date and efficient plant.

When the company took over the factory—an old cocoa works of 60,000 sq ft floor area—in 1925 the intake of raw materials and the despatch of the finished products were both carried out at the same end of the building and this arrangement continued until 1948. Then, however, with the completion of a new receiving bay, which, with other additions carried out meanwhile, brought the size of the factory up to 195,000 sq ft, it was decided to rearrange production almost completely so that from the entry of raw materials at one end of the building production flowed in logical sequence practically in a straight line through the machine



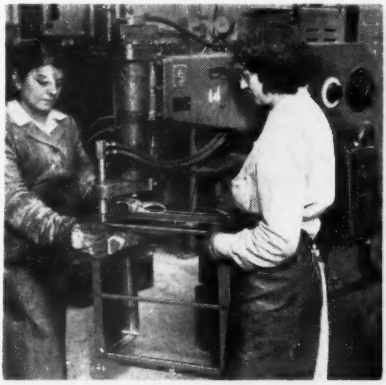
shop, welding, sub-assembly, finishing, final assembly and test sections, until it reached the packing and despatch department at the other end. In this scheme use was made of the fact that the site on which the factory stands has a natural slope of 11ft from the receiving to the despatch departments.

The extent of work involved in this reorganization is indicated by the fact that in all departments except the boiler house and vitreous enamelling section virtually every single piece of plant had to be moved and in many cases replaced by newer apparatus. Furthermore, both the vitreous enamelling and plating shops were considerably extended, the polishing section being rearranged to give the polishers better lighting on their work. Almost every piece of plant throughout the factory is now individually driven by its own electric motor.

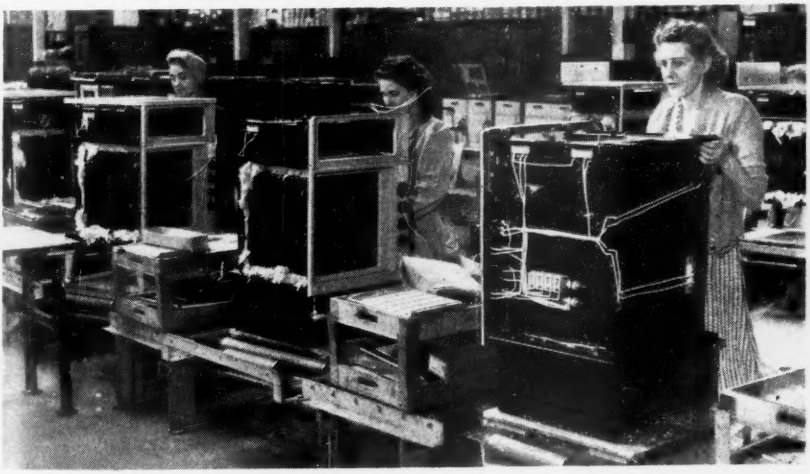
New Machine Shop

The provision of the new 40,000 sq ft machine shop renders the company almost independent of sub-contractors, the only items bought outside being the small number of castings used, standard screws and nuts, mouldings and ceramics. As a result the company claims that it makes in its factory a higher proportion of its cooker components than any other manufacturer.

The company's policy since the war has been to reduce drastically its range of products so that to-day it is concentrating entirely on cookers, breakfast cookers, fires and irons. With production of the last two items restricted, one by Government control and the other by a largely saturated market, it is the cooker side of the business that is engaging the company's main attention at the moment, demands having to be met not only from all but one of the Electricity Boards in this country, but also from Australia, Tasmania, South Africa, India, British East Africa, Peru and many other countries.



Below : Wiring is made easier by the use of turntables. Above : Spot welding a cooker plinth



To achieve maximum output of cookers the company is concentrating on one single basic model, which is, however, available in three types—with legs, plinth or drawer. Except for the cast front frame and hob, a pressed sheet steel construction has been adopted throughout. Even the attractive handles which, until closely inspected, appear to be mouldings, are pressed out of sheet in five operations, the design being such as to give minimum heat transference.

Saving Labour

In the initial stage of production a considerable amount of labour is saved by the employment of rotary shears instead of guillotines to cut up the sheet steel into strips of the required width. Much use is made of "Zintec" sheeting (steel with a coating of zinc rolled on) for certain components since this eliminates the need for "bonderizing" before enamelling.

One 300-ton and two 200-ton presses enable deep clean drawings of large pressings to be made in a single operation. Banks of smaller presses and also multiple drilling machines have been so arranged that components, whether requiring treatment in all or only some of them, can travel without delay down the production lines. Fly presses are still found most suitable for short runs of small parts. Girls are employed exclusively for operating even the largest presses. The only skilled sheet metal workers are four men engaged on plant maintenance and on the preparation of prototypes. Also to be seen at one end of the machine shop are surface grinding machines arranged to deal alternatively with four 8in solid hotplates or seven 6in hotplates. The special attention paid to the cleaning and conservation of oils and greases is found not only to save lubricants but to eliminate much scrapping of components.

From the machine shop, components are gathered together in the pre-welding stores whence they are issued to the welding department. Here both spot and projection welding are employed for fabricating such items as cooker plinths, oven interiors, fire bodies and the braking mechanism on bathroom fires and for attaching earth bonding washers. Components then go into the pre-finishing stores.

Considerable pride is taken by the company in the quality of its finishes. All fabricated articles are first cleaned in trichlorethylene, castings being shot-blasted. Facilities are provided for all types of electroplating—zinc, copper, tin, silver, nickel, chrome, etc., and a novel feature of production, requiring a special technique, is that fire reflectors are plated before bending to their required shape.

Provision is made for the installation of seventy polishing lathes, but restrictions on manufacture of fires on the one hand and on

The end of a cooker production line where the electrical testing is carried out

the other improved methods adopted by the polishers, all of whom have been trained in the factory, make such a large number quite unnecessary at present. The unoccupied space in the polishing department is used for the production of imitation coal and log fuel effects, specially stiffened and fire-proofed fibre and metal foil being used for this purpose.

"Calder" log effect fires being assembled

Before enamelling, sheet metal parts which are not vitreous enamelled (when not of "Zintec") are rustproofed by the "bonderizing" process. Infra-red ovens are employed to stove these components. In the vitreous enamelling shop three out of four of the box type muffles are in continuous operation. As one of the methods adopted to avoid subsequent damage to vitreous enamel due to imperfect fitting, it is worth mentioning that jigs are employed during the firing of such components as hotcupboards.

Cooker Assembly

In the assembly department four parallel lines have been laid out to produce 800–1,000 cookers a week. Sets of components from the adjacent sub-assembly department are placed on conveyors ready for the first operation, the attachment of the oven interior to the front frame and base. The hotcupboard and lagging are then added and the plinth or sheet steel legs are fixed. After the switches and oven thermostat have been installed, the boiling plate support brackets are fitted, followed by the hob. Earth bonding is carried out progressively as the assembly proceeds, the wiring proper being facilitated by the use of turntables. The leads are cut to length before installation, but it is not considered worth while to preform them.

The boiling plates and oven elements are first fitted roughly without adjustment. The door, after fitting into its frame to a paper gauge tolerance, has its panel and handle attached. Braking mechanisms are fitted on each side of the hotcupboard door, the interior of which is designed to prevent any spill-over getting into the door. Except for the side panel, the cooker is now complete.

Electrical tests first check the wiring and the loading of the hotplates and oven elements, insulation being tested in a flash cage at 1,000 V. Every oven thermostat is then recalibrated and the assembly is completed by putting on the sides, levelling the hotplates and adding the oven and hob accessories. After final inspection, the cooker goes to the despatch department. Facilities for testing cookers under actual operating conditions and comparing their performance with that of other manufacturers' cookers are provided by a well equipped demonstration kitchen.

To maintain a steady labour force production of breakfast cookers, irons and fires is spread over different periods. This is necessary because it would, for instance, be possible to make in a few weeks a year's quota of fires. The production of the eight types of imitation fuel, reflector and bathroom fires has been so arranged that two pairs are made from the same basic design. Both standard and thermostatically controlled irons are made, the latter being tested by being brought up to their operating temperature three or four times.

To avoid staggering or having to shut down any of the plant due to load shedding, a 250 kVA Paxman-B.T.H. diesel alternator has been provided which is capable of taking approximately 40 per cent of the factory load.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Design of Domestic Appliances

DOMESTIC electrical appliances are still tied too closely to non-electrical designs. The coal or gas heated kettle functioned well enough, but its design was evolved for the specific purpose of holding a given mass of water over an external source of heat. Hence it presented as large an area as possible to the flames. When the appliance is changed over to electrical heating with the immersion type heater, there would seem no point in retaining the old kettle shape.

A more logical design for the electric kettle would be a cylindrical container fitted with a draw-off tap, and standing on three short legs having fibre tipped feet. The design, of course, would resemble that of a tea urn, but the tap alone, by eliminating the handling of a kettle full of boiling water, would strongly appeal to many women.

An indispensable accessory to the externally heated flat iron was the iron-holder, but in spite of this most users suffered burns at some time or other. Because external heat had to be applied, little protection could be provided. The electric iron is self-contained, yet it is somewhat remarkable that with the greater number of the irons sold it is still possible for the user to suffer an unpleasant burn should she change her grip, or stretch her fingers. Again, heat rising from the iron to the hand can prove unpleasant and tiring.

A few manufacturers have provided their irons with a moulded handle with a heat shield, but even these seem to use unsuitable quality moulding powders. Such handles incorporate lightly knurled, internally threaded brass inserts which pull out when the moulding expands under heat.

The domestic hot water bottle, of a necessity, has to have a screwed filler plug, but surely, when it is electrified there is no need to perpetuate the same outline. Far too many appliances give the impression that the electrical part has been put on as an afterthought.

F.R.S.

First "Tube" Railway

I READ with a good deal of interest the opening paragraph by "Reflector" in your issue of 22nd December. Quite recently a number of short articles have appeared in the national Press regarding the old City and South London Railway and most of them have been grossly inaccurate, whereas the paragraph by "Reflector" is the most accurate that I have seen so far.

I would, however, refer to one point which may be of interest to you and that is it is not quite true to say that the first 14 locomotives were built by Mather & Platt to the designs of Dr. Edward Hopkinson. In point of fact two of them were built by the Thames Iron Works and fitted with Crompton motors to the designs of the late Col. Crompton. One of these was of the direct drive type similar to the Mather & Platt locomotives, but the other, incidentally numbered Locomotive No. 2, was fitted with motors driving the axles through gearing. It is true to say that this locomotive was never very successful but the historical fact of its origin remains.

The other point of interest is that all these locomotives were subsequently rebuilt as geared locomotives fitted with B.T.H. motors and the four original Mather & Platt type dynamos, which were belt driven from vertical Belliss & Morcom steam engines were subsequently re-erected in the new power station at Stockwell in 1904, mechanically coupled back to back and used as motor generators to supply the outers of the ± 1,000 V d.c. five-wire system.

These motor-generators continued in service until 1915 or 1916 when the Stockwell power station was closed down and the lines were fed from Lots Road power station with a supplementary supply provided by the County of London Electricity Supply Co., Ltd., for the southern end of the line.

Leatherhead. R. A. McMAHON.

Commerce and Industry

New Building Centre

Display Lighting Restrictions

THE Council of the Building Centre has felt for some time that its premises are inadequate for its activities and for future developments and it has now acquired a building which will meet its need for some years to come in Store Street off Tottenham Court Road and adjacent to Bedford Square and London University. The building has about three times the area of that at present in use and it is in a convenient position for those engaged in the architectural profession and the building industry.

Apart from the very great increase of space available for exhibits it will be possible to provide a theatre for lectures and film demonstrations and also to allot a considerable area for temporary exhibitions. The building needs certain alterations and repair of war damage and it is not yet possible to say how soon the Building Centre can be transferred. Exhibitors will be communicated with immediately preliminary plans have been made for the layout.

Battery Industry Statistics

In a preliminary Census of Production report (No. 103) the *Board of Trade Journal* gives particulars of the battery and accumulator industry. The number of establishments covered is 52, representing about 97 per cent of the total net output of the industry. It is shown that in 1948 these establishments' gross output had a value of £19,874,000. After meeting the cost of materials (£11,185,000) and amount paid for work given out (£13,000) the value of the net output was £8,676,000. Wages and salaries amounted to £4,467,000 and the net average output of the 15,347 people employed was £565.

An analysis of employees shows that they were roughly equally divided between males and females. Of the total 12,343 are shown as operatives and about 3,000 as administrative, technical and clerical staff.

Arts and Crafts Exhibition

A National Arts and Crafts Exhibition for employees in the electricity supply industry and members of their families is being arranged at the Old Horticultural Hall, Vincent Square, London, S.W.1, on 15th, 16th and 17th February, 1951.

There have been thirty-one eliminating exhibitions throughout the British Isles, and from these the prize winning and specially commended exhibits have come to London to form the National Exhibition. The exhibition is divided into twenty-three classes, and many of the works are by well known exhibitors. Music as an art will be represented by the London Electricity Music Society which will give performances during the run of the Exhibition.

Switchgear Production in Devon

Expanded production of l.v. industrial switchgear is expected to follow the move of G.M. Engineering (Ottery St. Mary), Ltd., from North Acton, London, to Ottery St. Mary, Devon. The Otter Mill, a handsome building

Converted mill as switchgear factory

of red brick, which has been completely renovated, was built in 1790 at a cost of £40,000. One important addition made to the building is a modern fabrication shop for switchboard assembly.

The company's central sales office remains at 1, Victoria Street, London, S.W.1 (Abbey 5095).

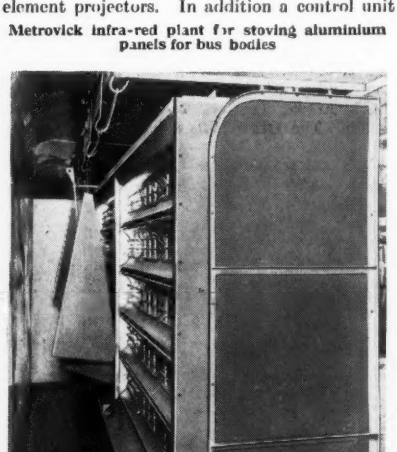
Copper, Lead and Zinc Prices

The Ministry of Supply announces that from Monday last, 8th January, the prices at which copper, lead and zinc will be sold (subject to licence) by the Ministry to consumers in the United Kingdom will be the prices ruling on the next working day after the consumer's order is posted, and not, as at present, the day on which the order is posted.

Infra-Red Paint Stoving

A new plant incorporating Metrovick infra-red element projectors has recently been installed by the Metropolitan-Cammell Carriage & Wagon Co., Birmingham, for paint stoving 20-gauge aluminium panels used in the building of single and double-decker omnibus bodies. As shown in the accompanying illustration, a single bank of element projectors is mounted on a wheeled track facing a reflecting surface to form an open tunnel. This arrangement enables different sizes and shapes of panels to pass through on the conveyor. The panels are sprayed with undercoating on both sides and then stoved, after which a top coat is applied to one side only, followed by stoving. The panels are then ready for immediate assembly. The plant is fitted with ten 7ft 6in infra-red 6 kW element projectors. In addition a control unit allows variation in electrical loading and temperature of the projector bank to suit different stoving requirements.

Metrovick infra-red plant for stoving aluminium panels for bus bodies



Fuel Economy Measures

The Minister of Fuel and Power has made the Advertisement Lighting (Prohibition) Order, 1951, which came into force last Monday. This Order prohibits the use, for the purpose of advertisement, of lighting which uses electricity, gas, oil or candles. The only exceptions are the use of electricity obtained from a windmill generator and electricity for the projection of films or slides on screens in theatres and cinemas.

The only existing restrictions on advertisement lighting were those imposed by the Electric Lighting (Restriction) Order, 1949 (as amended). This prohibited the use of electricity from the public supply for advertisement lighting between 7 a.m. and 6 p.m. on Mondays to Fridays and its purpose was to reduce load shedding. In view of the shortage of coal, it is now necessary to make the prohibition apply at all times and to extend it to other fuels.

In a broadcast address on Saturday last Mr. Noel-Baker appealed to the public to prevent a fuel crisis which might otherwise occur at any time during the next twelve weeks. As well as domestic consumers, factories, shops and offices could contribute to the saving of fuel.

Relayed Television

The Rediffusion Group of broadcast relay companies have developed practical systems of television rediffusion which they are now installing. Viewers will have interference free television and a choice of broadcast programmes brought to their homes for a weekly charge, including hire of the receiver, full maintenance and replacements. The group has spent over £100,000 in the last fifteen years in research and experiments on "television by wire" systems. One of these, a communal television aerial system, has been in operation in London flats and hotels since 1937, while another will supply simultaneous distribution of more than one television programme in addition to a choice of broadcast programmes.

Purchase Tax

A new Notice 78 containing up-to-date particulars of purchase tax arrangements has been issued by the Commissioners of Customs and Excise, City Gate House, Finsbury Square, London, E.C.2.

Scientific Grants

Grants of up to £600 a year are now available to science graduates in Northern Ireland who wish to devote the whole of their time to research. These grants, which take the form of Senior Research Awards of the D.S.I.R., are normally for a period of two years and are tenable at any institution in Great Britain (or, in certain cases, abroad) approved by the

dvisory Council. Applicants must show exceptional ability and they will compete with candidates from all parts of Great Britain. Details of these awards and the method of application for them have just been published by H.M. Stationery Office in "Notes on Grants Awarded by Department of Scientific and Industrial Research to Research Workers and Students" (price 4d).

Quarries and Metalliferous Mines

The Minister of Fuel and Power has decided to postpone for the time being the making of the Quarries (Electricity) (Amendment) General Regulations, 1950, and the Metalliferous Mines (Amendment) General Regulations, 1950, which were published in draft with Safety Circular No. 184.

Revocation of the Quarries General Regulations (Electricity) (Exemption) Order, 1947, and the Metalliferous Mines General Regulations (Exemption) Order, 1947, which allow the continued use of certain electrical apparatus and cables, is similarly postponed.

Window Display Award

J. Mollett, Ltd., Darley Street, Bradford, the winners of a window display competition organized by Hurseal, Ltd., receive the first prize of £50.

Redundancy in Belfast

The Belfast correspondent of the *Manchester Guardian* reported last week that over a thousand electricians employed on the aircraft carrier *Royal Eagle* at Harland & Wolff's shipyard downed tools and marched through Belfast on 4th January. This was an act of protest against the dismissal of 600 members of their union as redundant. Later the men passed a resolution calling upon the area council of the Electrical Trades Union to co-operate with other trade union bodies to set up an employment committee in the shipbuilding industry.

A.S.E.E. Diploma Scheme

This year the Association of Supervising Electrical Engineers embarks on the sixth year of operation of its scheme for the award of the Swann Diploma in electrical installation practice and electrical maintenance. The scheme has been revised this year as a result of experience over the period of its operation and there will, in future, be separate examinations and diplomas for electrical installation practice and electrical maintenance, respectively, but no combined examination and diploma for both examinations together as was previously the case. Where a candidate shows a high standard of knowledge in technical ability or administration and organisation he may be awarded credits and where exceptional overall ability is shown he may be awarded honours.

The revised brochure giving the objects and regulations of the scheme and syllabus of the examination is now available from the General Secretary, A.S.E.E., 54, Station Road, New Barnet, Herts.

Physical Society Exhibition

The Physical Society's 35th annual exhibition of scientific instruments and apparatus will be held from 6th to 11th April, 1951, excluding Sunday. This year both the Royal College of Science Main Building, Imperial Institute Road, and the Huxley Building, Exhibition Road (opposite the Science Museum) will be used. On the first morning the exhibition will be open to members of the Society and the Press only, and all tickets will be valid for entry into both buildings.

Discourses will be delivered by several eminent scientists on four days of the exhibition, and the prize-winning models in the Society's Craftsmanship and Draughtsmanship Competition will be on show. A handbook of the exhibition, containing full descriptions of all exhibits, will be obtainable from the Physical Society in early March.

British Plastics Exhibition and Convention

Further particulars of the British Plastics Exhibition and Convention, to be held in London from 6th to 16th June next are now available. More than sixty firms have arranged to show their products. The whole of the space on the ground floor of the National Hall, Olympia, is already allotted and the first floor is now being filled up.

A feature of the exhibition will be "The Story of Plastics," sponsored jointly by the organizers, the British Plastics Federation and the Council of Industrial Design. The exhibit is designed to demonstrate the chief properties and applications of plastics and to widen public understanding of their importance. There will be fifteen sessions at the Convention.

Hot Meal Service in Aircraft

The General Electric Co., Ltd., has received an order from British European Airways to supply 525 electrically heated food and liquid containers which are to become standard aircraft catering equipment in all the Corporation's aircraft. This container has been specially developed to solve the problem of providing hot food and beverages for aircraft passengers using the lightest possible equipment. The first prototype hot food unit was made by the G.E.C. to a design specification prepared by the Project and Development Branch of B.E.A. in April, 1950. The container is an insulated, double-sheeted metal box approximately 16in high by 8in square. Particular attention has been paid to thermal efficiency, and the production unit requires an electrical heating element rating of only 200 W. The stainless steel inner

canister may be loaded with either twelve plates of food or 1½ gallons of coffee, milk or soup. With the heating elements switched off, the temperature drop is guaranteed not to exceed 9°F/hr, and with the heating element on the temperature rise exceeds 25°F/hr. The weight is approximately 9lb. When used for liquids, a special lightweight tap can be fitted. In airline operation, food or liquids are loaded into the containers in the ground catering kitchens, ensuring hygienic handling and loading into the aircraft. The units can be plugged into a 28V supply in the ground kitchens if the aircraft departure is delayed. Aboard the aircraft, the heating elements are switched on a short while before the meal service to ensure that the food is served hot.

Works Managers' Conference

The third residential national conference of the Institution of Works Managers will be held at Southport from 13th to 15th April. The conference is being arranged largely by a local committee of members drawn from the Manchester and Merseyside branches of the Institution.

"The Sunvic Story"

Under this title Sunvic Controls, Ltd., Sunvic House, Essex Street, London, W.C.2, has produced a very handsome brochure in black and white and colour giving a brief account of the developments of "Simmerstats," temperature controllers, thermostats and relays and their various uses. The illustrations depict the manufacture and application of the company's equipment.

Electrical Commercial Travellers

The annual luncheon of the Electrical Trades Commercial Travellers' Association will be held on 16th February at the Connaught Rooms, London, W.C.2.

E.D.A. Annual Luncheon

The annual luncheon of the British Electrical Development Association will be held on 13th April at the Connaught Rooms, London, W.C.2, and will be followed by the annual general meeting.

Douglas (I. of M.) Exhibition

The electricity undertaking of Douglas (I. of M.) is owned by the Corporation and the consumers have been fortunate in obtaining supplies without regular cuts. The cessation of the bulk supply to the Isle of Man Electricity Board and the additional plant and mains now in commission, have placed the Electricity Department in a favourable position to meet any future development and its consumers have no fear of cuts in the supply. There has been no increase in price since 1943, although some revision of tariffs will be necessary owing to changing conditions, such as the revision of the rateable value of private houses, which will necessitate a change in the all-in tariff. It is hoped, however, that the further development of the load and increased efficiency of operation will make unnecessary any increase in tariffs.

With this happy state of affairs the Corporation Electricity Department is able to concentrate on developing its load, and as part of this scheme is at present holding an electrical exhibition (which commenced on 8th January), in which leading electrical manufacturers are taking part, at the Villa Marina, Douglas. The exhibition covers electrical apparatus and appliances for the home, while demonstrations are being given of hotel and bakery equipment, cookery and home laundry. The exhibition closes to-morrow (Saturday).

Colonial Service

More people are entering the higher branches of the Colonial Service than ever before. Outstanding vacancies—fewer than 1,000—are the lowest since the end of the war. Information about the opportunities offered is given in the 1950/51 edition of the Colonial Service recruitment pamphlet "Appointments in His Majesty's Colonial Service" (C.S.R.1) published by H.M. Stationery Office, price 2s. Engineering is among the branches with the greatest need for candidates.

Works Visit

It was announced last year that a large contract had been placed with the British Thomson-Houston Co., Ltd., for mining equipment for the Eregli Coal Mines in Turkey. A large proportion of the 3,500 40-W 4ft flameproof fluorescent lighting fittings ordered has already been shipped. A party of twelve Turkish engineers and technicians recently toured the Hereford factory where these B.T.H. fittings are being made in order to gain first hand knowledge of this type of equipment. This tour was arranged as part of a comprehensive training course for the benefit of the men who will be concerned with the installation and maintenance of the flameproof equipment at the various mines where it is being installed.

Controlled Exports

The Board of Trade has made the Export of Goods (Control) (Consolidation) Order, 1950 (S.I. 1950 No. 2138, H.M. Stationery Office, 1s). This supersedes the Consolidation Order of 1949 and eight subsequent Amendment Orders.

New Railway Rolling Stock

While the bulk of the 400 locomotives to be built under the 1951 programme of British Railways will be steam-operated there will also be 51 diesel-electric and four diesel-mechanical shunting locomotives. The diesel-electrics will be of the 0-6-0 type rated at 350 h.p.; 36 of them

are for the Eastern and North Eastern Region and 15 for the London Midland Region.

For the electrified lines 124 third class motor coaches and 64 trailer coaches are to be built.

Trade Announcements

Measurement, Ltd., announces that owing to the growth of activities in remote control and indication fields the company has formed a Remote Control Division which is now operating from 7, Fitzalan Street, Kennington, London, S.E.11.

The address of the Plymouth branch of **Simms Motor Units, Ltd.,** is now 85, Cattedown Road, Plymouth. The telephone number is unchanged.

The Industrial Department of **Philips Electrical, Ltd.,** which was previously operated from 122, Snow Hill, Birmingham, is now accommodated in the main branch premises at 28a and 28c, Ludgate Hill, Birmingham.

Leyland Motors, Ltd., and **Auto Diesels, Ltd.,** Uxbridge, have made an agreement whereby the latter company will build exclusively a modern range of high speed generating sets incorporating the Leyland engine, under the name of "Leyland Auto-Diesel."

Linolite, Ltd., has appointed Mr. W. Reay of J. J. Hyde, Ltd., 38, Bedford Street, Belfast (telephone: 21789) as representative in Northern Ireland, and Mr. C. Nolan of Charles Nolan & Co., 2, Parker Hill, Rathmines Road, Dublin (telephone: 93510) to represent the company in Eire.

Mr. D. B. Francis has been appointed representative of **Ekco-Ensign Electric, Ltd.,** in the South-West Wales area. He will operate from the company's office at 50, Bridge Street, Cardiff. Mr. Francis was previously sales engineer in South Wales for Veritys, Ltd.

Mr. G. D. Harrison, electrical manufacturers' stockholder and agent, Huddersfield, has opened a new trade counter and showrooms at 55, Northgate, Huddersfield, and a new company with the title of **G. D. Harrison & Sons, Ltd.,** has been formed for this purpose with a capital of £10,000.

Tinplate Workers' Scholarships

In 1951 the Worshipful Company of Tinplate Workers is to offer up to twelve travelling scholarships of the value of £50 each, on the same conditions as those awarded this year.

Educational

A course of six lectures on "Magnetic Materials" will be given by Mr. A. E. DeBarr on Wednesday evenings, commencing on 31st January, at the Northampton Polytechnic, St. John Street, London, E.C.1. The fee for the course is 20s and applications will be received up to 29th January.

E.C.A. East Kent Branch

The annual dinner of the East Kent Branch of the Electrical Contractors' Association will be held on 8th February at the County Hotel, Canterbury. Tickets (25s each) can be obtained from Mr. A. Apps, chairman of the Branch, at 1 and 2, North Lane, Canterbury.

Catalogues and Lists

Wm. Dibben & Sons, Ltd., 103, St. Mary's Road, Southampton, Hants.—Priced wholesale catalogue of electrical equipment and accessories.

Scemco, Ltd., Soho Street, London, W.1.—Wallet containing leaflets and price list of fluorescent lighting fittings.

Brush Electrical Engineering Co., Ltd., Loughborough.—Technical brochure (No. 41009) on vertical draw-out pattern metal-clad switchgear, type VU, with ratings from 1,200 A to 3,000 A at up to 600 V.

Warm-Glow Co., Ltd., Leigh-on-Sea, Essex.—Illustrated folder announcing increased prices of electric blankets.

Pruden & Pope, 117 Westmount Road, London, S.E.9.—Illustrated folder and priced leaflet on the "Slide-Along" l.v. busbar lighting system.

Renold & Coventry Chain Co., Ltd., Renold Works, Didsbury, Manchester, 20.—Price list of stock conveyor chains and wheels.

Wholesale Fittings Co., Ltd., 46, 50 & 52, Commercial Street, London, E.1.—Priced and illustrated catalogue (No. E403) of lighting glassware.

Thorn Electrical Industries, Ltd., 105-109, Judd Street, London, W.C.1.—Illustrated brochure (AL/89) in full colour outlining the possibilities of "Atlas" display lighting.

Associated Fire Alarms, Ltd., Sutherland Works, St. Andrew's Road, London, E.17.—Illustrated brochure describing automatic fire detection equipment.

Precision Components (Barnet), Ltd., 13, Byng Road, Barnet, Herts.—Leaflet on the "Kabi-Austinlite" 10-way and off double-pole rotary switch.

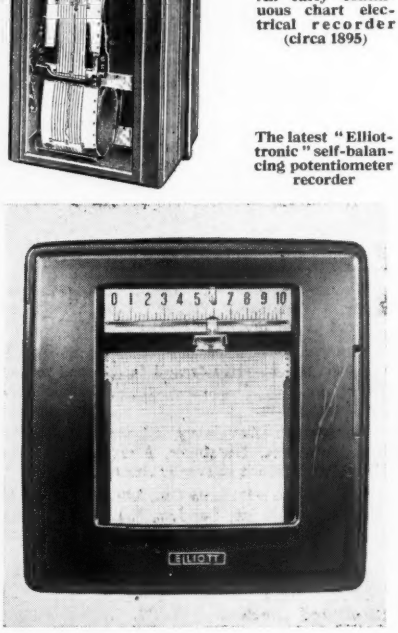
Bescol (Electric), Ltd., Parkfield Road, Saltley, Birmingham, 8.—Priced folder on "Bescol" space heating equipment and "Elephant" kettles.

G. B. Equipments, Ltd., Mortimer House, 37-41, Mortimore Street, London, W.1.—1951 catalogue of entertainment films (16 mm.), including particulars of a number of industrial films, with details of hire charges.

A Century and a Half

Elliott Brothers' Record in Instrument Making

An early continuous chart electrical recorder (circa 1895)



The latest "Elliottronic" self-balancing potentiometer recorder

IN 1795 a young man named William Elliott was apprenticed to a compass and drawing instrument maker in London. Owing to the death of his master he was unable to complete his apprenticeship, but he had learned enough to found, in 1800, a successful business in a small room in a house in Sash Court, Gray's Inn, working for the trade as a maker of drawing instruments. By 1807 he was able to lease a shop and workshop in High Holborn, and to extend his activities to surveying and mathematical instruments.

With the passing of the 1828 Act for the construction of a railway between Liverpool and Manchester there was such a large demand for theodolites and surveying instruments that Elliott had to move to larger premises at 56, Strand, taking into partnership his two sons, Frederick Henry and Charles Alfred. Here he began to exploit the field opened up by the growth of the railways and the widespread use of steam power, and his "steam engine indicator" remains basically unchanged to-day.

At the same time, there was great activity in all branches of physical science and this resulted in the manufacture of a wider range of scientific instruments such as spectroscopes, induction coils, electrometers, chemical balances and other apparatus for such great scientists as Michael Faraday and Sir Humphrey Davy.

In 1853, William Elliott died, leaving the business to be carried on by his sons under the style of Elliott Brothers. Soon the business of Watkins and Hill was absorbed and the whole concern was transferred to 5, Charing Cross. A few years later there was a further move, to 112, St. Martin's Lane, and a retail branch was opened at 449, Strand. It was about this time that Charles Elliott retired leaving his brother as sole proprietor. When he died in 1873 Frederick left the business to his widow, who later joined partnership with Mr. Willoughby Smith, and as neither took an active interest in the business, Mr. Charles Becker became manager, and Mr. W. O. Smith, the son of Mr. Willoughby Smith, began his long association with the company.

During this period, great developments occurred in the electrical world. In 1851 the first successful submarine cable was laid across the English Channel and the cable business boomed. The firm embarked on the manufacture of Wheatstone, Morse, Hughes and other manual, semi- and fully-automatic telegraph instruments.

In 1874, the firm started making electrical standards for the British Association Standards Committee as well as electrical measuring and testing instruments for the

electrical industry and signalling instruments for cable stations. The continuing growth of the business necessitated the building in 1876 of new works at St. Martin's Lane, London, which were occupied by 1878. About this time orders were being executed for the Admiralty for such items as "ships' directors" and torpedo directors.

In the late '70s and early '80s the firm was making instruments for the rapidly expanding electric lighting industry, the progress culminating in 1894 in the introduction into this country of the first permanent magnet moving coil instrument. A year or so later there were produced the first practical pivoted dynamometer instrument and accessories for a.c. work, and current and potential transformers. There was also the first practical graphic recording instrument. For some time complete switchboards were supplied but this branch was later abandoned to facilitate concentration on measuring instruments and accessories.

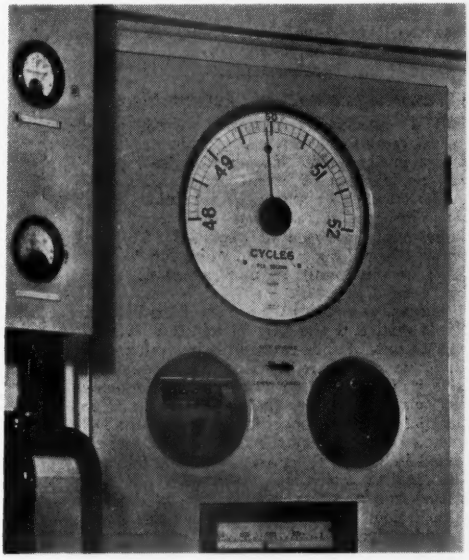
Mrs. Elliott had died in 1881 and in 1891 Mr. W. O. Smith entered into partnership with his father. Two years later, arrangements were made with Mr. G. K. B. Elphinstone, proprietor of Theiler & Co., to amalgamate the two concerns under the style of Elliott Brothers. In 1899, land was bought at Lewisham, where in 1900 the present factory was opened under the appropriate title of "Century Works."

The production of all kinds of electrical measuring instruments was increased and the company introduced the first motor car speedometer. Work for the Admiralty continued and in 1908 the development of naval fire control equipment was started. This simple apparatus progressed to the elaborate calculating tables fitted in H.M.S. *Nelson* and *Rodney* and finally to the complicated predictors installed in H.M.S. *Vanguard*. The company was also responsible for the design of the Forbes log, the first underwater log to be fitted in this country, and the manufacture of the first gyro compass for the Admiralty. During the first world war equipment of all kinds was manufactured in large quantities, including bombsights, gunsights, torpedo gyros and altimeters. Pioneer work for the R.A.F. included the development of bombsights.

The manufacture of heat and process control apparatus was added in 1930. Among later developments were remote indication transmission systems, the precision deflectional frequency indicator used on the grid system, instruments for the measurement of power factor and specialized equipment for the N.P.L.

During the last war many thousands of instruments and other apparatus were produced for the services including blind landing instruments, true wind speed and direction indicators, gyro gunsights, various instruments and thermal units for radar, as well as industrial instruments.

Since the war the company has become associated with B. & P. Swift, Ltd., hydraulic and mechanical engineers, and additional accommodation has been acquired at the former Short aircraft works. New laboratories have also been established at Borehamwood, Herts, where the investigations cover a wide diversity of measurement and control problems and the application of electronic techniques.



Elliott precision frequency meter in the B.E.A. National Control Centre

Mechanical Handling

Study of American Methods

THE team which visited the United States in 1949 to study ways and means in which materials are handled in industrial establishments there published its report* in May, 1950. Three of the twelve members of that team, Messrs. A. Roebuck (Hadfields, Ltd.), H. S. Carnegie (English Electric Co., Ltd.) and E. G. Taylor (G.E.C.), together presented a paper last week to a joint meeting of the Institutions of Mechanical and Electrical Engineers in London in which they enlarged on some of the conclusions listed in the report.

Their object was to focus attention upon the value of these methods inside factories. In the opinion of the authors, better facilities for mechanically handling materials offered more opportunities of reducing production costs and increasing productivity than any other single factor. They stressed the need to employ more extensively known methods and equipment already available in Britain.

Factory managements in the United States reviewed continuously the equipment and arrangements they used with the object of progressively improving them. But layouts were altered and additional equipment was purchased only when the expense was shown to be justified by a recovery cost. Time-cost analysis of processing was therefore a necessity; examples were given in the report and the paper illustrated and described a variety of handling appliances and methods.

* "Materials Handling in Industry," Anglo-American Council on Productivity, 21, Tothill Street, London, S.W.1, price 2s 6d.

Development of Inventions

THE National Research Development Corporation was set up in 1949 to secure in the public interest the development and exploitation of inventions resulting from public research or any other inventions which the Corporation considers are not being sufficiently developed or exploited. The first report of the Corporation (of which Sir Percy H. Mills is chairman) is now available (H.M. Stationery Office, 6d).

The report outlines the nature of the Corporation's task and the way in which it is being carried out. Public research is in the hands of Government departments or bodies operating with public funds and grant-aided autonomous institutions, namely, the universities and industrial research associations. Among the last-named are mentioned the British Electrical and Allied Industries Research Association (E.R.A.), the British Scientific Instrument Research Association and the British Welding Research Association. The Corporation has given close consideration to the question of assisting each association to utilize to the fullest possible extent the possibilities of inventions which it may make.

It is acknowledged that rights in such inventions as these bodies may make unquestionably belong to their members. Where independent firms or individuals seek assistance the method of procedure is to set up a limited liability company owned jointly by the inventor and the Corporation, with control in the latter's hands. Working capital will be provided by a debenture held by the Corporation and charged on the company's assets.

As a result of the first year's work, 66 inventions are under active exploitation, including 40 from Government Departments, 16 from universities and only two from members of the public. Actually 965 inventions were submitted (444 from Government Departments, 20 from universities and 485 from members of the public). At 30th June last 530 inventions were under consideration or awaiting formal transfer.

Power Station Bonus Dispute

MEMBERS of the technical and clerical staff formerly with the London Power Co. and the Northmet Power Co. and now employed by the British Electricity Authority held a meeting in London on 4th January to protest against the abolition of the Christmas bonus which they received before nationalization and in 1948 and 1949.

At the meeting it was said that although the abolition of this bonus was the primary reason for the meeting the loss of other former privileges by members of the staff was also considered. Reference was made to the fact that a bonus was paid in 1950 to men at London power stations who struck in December, 1949, whereas the loyal staff who did not strike were deprived of their bonus.

The British Electricity Authority contends that upon the introduction of the new agreement dating from 1st July, 1949, the 7½ per cent bonus should merge with the increases in salary for which the agreement provides.

A "Bonus Committee" was formed in October last to maintain the bonus rights of the employees affected and it is stated that this has the recognition of the Electrical Power Engineers' Association.

The meeting decided that the Bonus Committee should act as a deputation to the Minister of Fuel and Power to appeal against the B.E.A.'s decision. Lord Citrine, chairman of the B.E.A., is also to be approached in this matter.

E.R.A. Annual Meeting

THE annual general meeting and luncheon of the British Electrical and Allied Industries Research Association will be held on 9th February at the Connaught Rooms, Great Queen Street, London, W.C.2.

ELECTRICAL CONTRACTING: Organization and Routine

By H. R. TAUNTON, A.M.I.E.E.

21.—*Costing*

A COSTING system accurate enough to be a check on estimating—which is, of course, the essential reason for keeping costs at all—means, for a business with even a moderate turnover, the whole-time labour of a clerk. But it is largely routine, well within the competence of a junior under supervision. The small increase in the salary list may easily be saved by a costs record disclosing an incipient loss on a running contract, or by its aid in avoiding the repetition of a loss on one completed. To any reasonable business man the objection of expense can carry no weight. To reduce standing charges by cutting out an essential process of the organization is like trying to economize on a car by cutting out the lubricant.

There is no standard system of contract costing, and each firm has to work out its own, on more or less obvious lines. Some are content with loose slips of paper clipped together, filed with the separate contracts. Others make a fetish of elaborate card systems, housed in costly oak. Both extremes are open to objection.

Suggested System

By far the best medium is a big ledger, to hold together all records large and small. A loose-leaf ledger is the ideal, avoiding repeated transfers and allowing some order, numerical or alphabetical, to be maintained. Once a contract is completed the pages dealing with its cost may be filed away with other contract papers. It will be found better, however, to keep all costs records together, removing closed accounts to standard binders, which can always be referred to—if properly indexed.

Every hour of labour shown on the time-sheets, and every little item of material shown on incoming invoices, should be allocated to some account or other in the ledger. Every job, however small, should have its separate costs account. If a large contract can be divided, as is commonly done in estimating, into a number of sections, each should have its separate cost, as it has its separate day-sheet. Ideally, every extra to a contract should also have its separate cost, but in practice that is almost impossible to realize. It is not always easy to separate the time on an extra from that on some other extra or on the main contract.

Another difficulty is that the foreman will probably take the material needed for the extra from the general stock on the job without advising the office. The practical way, then, of dealing with a contract is to cost the main order and its extras as one, relying on the approximate details on the day-sheets for the pricing of the extras.

Day-sheet Quantities

If the details on all day-sheets, for extras covered by estimates or schedule rates and those on a day-work basis, are reasonably accurate and complete, the total quantities shown on them can be collected and deducted from those in the cost ledger for the whole contract. The difference will be (within the usually negligible margin of the foreman's error) the actual cost of the main contract without extras, which can be compared with the original estimate and taken as the basis of analysis.

In the most obvious and elementary of cost ledger accounts only two columns are used, one for labour and one for material; but this makes laborious any attempt at a comparative analysis. It is better to have as many columns within reason as the ledger will accommodate. Men's fares and expenses should be separated from the labour items and entered in a column with general office expenses.

Material might be dissected *ad lib.*, but half a dozen columns should do for all practical purposes. The most obvious for an ordinary wiring job are: "Conduit,"

" Cable, etc.," " Switchgear," " Accessories," " Fittings " and " Sundries."

These six columns and those for labour and expenses can be comfortably accommodated on a double page opening of a ledger, and leave enough space for other necessary rulings: a date column and folio reference column, and the main column in which will be written the description of the class of labour, or of the material, abbreviated as much as possible within the limits of clearness.

Credit returns may be dealt with in a separate column, or in the usual analysis columns in red ink, or on a separate page. The second method is the best on the whole, except perhaps for large contracts, where the third may be preferable.

Regular Reports

An important function of the cost ledger is to keep the manager or supervisor in close touch with the progress of every job in hand. A typed report should be laid before him at regular intervals showing for every job, big or little: the original estimate, divided into labour and material (selling figures); the total value of all extras ordered since, approximately estimated where necessary; the actual cost figures at date, labour and material; and the amount, if any, of cash on account applied for and received.

Such a report, taken in conjunction with the progress sheets of the various contracts, gives timely warning of any cost which shows signs of overtaking the estimate, so that whatever steps are possible shall be taken promptly to avert a final loss.

To the principal the chief interest of a costs account may be in its disclosure of a profit or loss on the contract, and to the accountant its use is only in the compilation of the final account.

To the buyer and the estimator it should be a measure of their past efforts and a guide to their future activities. The lessons to be learnt from it by the buyer are chiefly by way of correction of mistakes committed, and he will probably have heard all he wants to hear about those already.

The estimator's job is only half done when he arrives at a figure which he thinks should show an ultimate profit. Any fool, by almost any method, from infinitesimal calculus to tossing up, can arrive at a figure of some sort. But the only figure of any use is an accurate figure; and the only proof of its accuracy is in the actual cost. To complete his job properly the estimator must not only estimate, but satisfy himself by the hard facts of the cost ledger that his estimate was correct; or, if not, how far and why it was wrong.

The first obvious step in checking costs against estimates is to clear them of all items entailed by extras, as already suggested. What is left is the net cost of the contract, comparable with the estimate. Is the cost lower or higher than was estimated? In either case, why?

The divergence is most likely to be in the labour column and this should be first examined. If it is high it may be due broadly to one or more of three causes: heavy unforeseen contingencies, poor output, and a mistake of the estimator himself. Heavy unforeseen contingencies will probably have obtruded themselves in the progress of the work. If they have not they should now be recognized and defined; and the estimator will have the modest satisfaction of knowing that he has been the victim of bad luck, or he will have learnt a valuable lesson for his future guidance.

Poor output is a definite possibility when strangers are taken on for a large contract, or even when the permanent hands know that trade is slack and there is a likelihood of their being " stood off " at the end of the job. Wherever the fault lies, with foreman or supervisor, it is obviously important that it should be found and suitably provided against for the future.

Possible Errors in Constants

Finally, an unexpectedly high labour cost may be due to a mistake of the estimator himself—which he will naturally be less willing to admit. But a reasonable fellow will be glad of the chance to learn his error. He may, by a careful re-check, discover a glaring one, previously overlooked. More probably, the mistake will be in one or more of the standard rates on which he based his estimate, particularly if the job has involved the use of special sizes or types of material, for the labour on which he has less experience to guide him.

He will probably have sufficient confidence in the accuracy of most of his constants—for example, for the smaller sizes of conduit—to rule them out of the discussion, leaving, perhaps, about half a

dozen items, one of which is then, by assumption, responsible for that excess. There are likely to be multiple items: items in which the initial error in the constant is sufficiently multiplied to account for the discrepancy.

Having thus limited his probable field of error, he has now to determine, if he can, which one or more of them is the offender. He may, for instance, select of the half-dozen, the largest—not necessarily in value but in quantity—or the one of which he has had least previous experience. If then he finds that a reasonable percentage increase of his estimated constant for that item would alone account for the whole discrepancy, he might be justified in assuming that he has located his fault; but it may still be partly in some other of the suspected items. He may proceed to eliminate them, if possible, by comparison with costs in which similar material has been used. He may be assisted, again, by the fact that they appear in day-sheets for extensions or extras to the job, in which case the labour against them may be more defined He will be helped if the cost has been sectionalized in the same way as the estimate; and the general routine of the job is sometimes an assistance.

In one way or another, by the exercise of ingenuity and common sense, it is generally possible for the investigator, once persuaded that his estimated figures were wrong, to find out, if only approximately, where and by how much they were wrong. It means a little trouble, but it is trouble well spent.

Reference to Past Contracts

Having decided the constants which require revision, the estimator will want, if it is possible, to arrive at figures accurate enough for future estimating purposes. An obvious resource is the cost of some past contract from which the required constants may be more easily deducible than from the usual mixed job. Failing that he can always devise a special check, if at the time or in the early future some job is in progress on which the particular item about which he is in doubt is being used.

Useful information on labour constants can also be obtained from day-sheets if they are filled in, as they should be, with reasonable accuracy. When they are for extras they often include special material involving the less common labour constants.

If the day-sheet is covered by a schedule rate or a special estimate, its cost should be checked to show something like the profit expected. It is as easy to make a mistake in a small estimate for an extra as in a large one for a contract.

A discrepancy in the material, whether in rates or quantities, is more easily located. The fault may be the estimator's, a wrong use of his catalogues or a sheer slip; it may be the buyer's, who has not followed the estimator's lead. It is, however, more likely to be in the quantities. A tabulation of the different items in the cost will quickly discover to which the excess—or more rarely, the deficit—is attributable: usually the conduit and cable and similar measured quantities. The estimator has had, as a rule, to arrive at them from plans. He may not have allowed sufficiently for detours made necessary by structural details, or he may have plotted on paper runs impracticable on the actual job. On the other hand, the fault may be with the foreman's bad judgment in " getting out " his runs, or with the men's carelessness or abnormal waste.

Memory and Guesswork

The analyses suggested depend for their utility on the assumption that the costs are complete in every way and absolutely accurate. It is from the point of accuracy, particularly of pricing, that most cost ledgers lapse. With the commoner types of material there is a tendency to price them from memory or at some fixed standard figure, irrespective of the actual make, particularly when dealing with material taken from stock. Another source of weakness is the pricing of petty material and sundries, where a round figure is usually put down by guess-work. They should be priced strictly to the nearest penny so that their total equals that entered against the source of supply.

Further, there is, in the usual methods of costing, always the chance of clerical errors, of wrong entries, of duplications and omissions. That is inevitable with any system of single entry, as in the cost ledger, a book peculiar to a few special trades. Because it is not one necessary to a double entry system, it does not share the check on accuracy provided by that system It is possible, however, to ensure that accuracy by slightly adapting the commercial books

so that they show figures which can be used to check those in the cost ledger.

Consider first the material. Invoices for plant, stationery, and the like, which cannot be debited to any cost account, are usually journalized for posting to various nominal accounts. For our present purpose, what matters is that they should not appear in the body of the bought day book, which should be reserved for productive material only, entered both in it and the cost ledger. It is then only a question of checking the periodical totals of the bought day book against the sum of the totals in the cost ledger " material " columns at the same date, making allowances for stock entries and the value of work in progress (material only) at the beginning of the period. The two figures should tally exactly.

Stock Summary Account

Stock must be taken into account, as a number of invoices in the bought day book will be for material bought for stock and not directly for a contract. There is no difficulty in doing this if a " Stock Summary Account " is kept in the cost ledger, as recommended in an earlier article. Two other similar accounts—costs accounts without the labour columns—are needed to cover the case of purchases for resale of materials involving no labour and sold direct from stores or showroom.

In one, the " Credit Sales Account," will be entered the cost of all items sold to the orders of credit customers, not forming part of a contract. In the other, the " Cash Sales Account," will be entered, almost always as a transfer from stock, the cost of all goods sold over the counter.

It remains to check the accuracy of the labour and expenses. The wages analysis book provides very simply the needed check on the former, if it is kept in a form which differentiates between productive and unproductive labour, as recommended. The total of so many weeks' labour shown in the " productive " column of the wages analysis book should tally with the totals of the labour columns in the ledger, after allowing for work in progress (labour) at the beginning of the period.

To provide a check on expenses is only a matter of reserving a column of the petty cash book for disbursements chargeable against the various jobs, and to be posted in due course to the expenses column of the costs accounts. The bulk of the entries in that column—workmen's fares and country money—will have been posted direct from the expenses column of the labour costs summary. The total of the expenses column in the costs ledger for a given period should then agree with the sum of the totals of the corresponding columns in both the wages analysis book and the petty cash book.

The only few entries not covered by this method are expenses paid by cheque, such as consultants' fees or supply companies' charges. They can be separately noted—say, by an asterisk—when entered in the expenses column of the ledger, and deducted from its total when the check is made.

Cash purchases for jobs may be either disbursements from the office petty cash or local expenditure by a foreman. The two should be brought into line and the necessary book-keeping entries made so that the man's cash purchases pass through the office petty cash, in a special column of the petty cash book.

So much apparent elaboration of detail and complication may seem superfluous, but it is no more than the keeping of the usual accountancy books in such a form that they provide the necessary checking figures. If it is worth while keeping costs at all, it is surely worth while taking a little extra trouble to have them accurate.

Bathroom Fatalities

AT an inquest at Lillington, Warwicks, on Mrs. Annie Jane Colman (47), her daughter stated that she found her mother unconscious in the bath with her hand touching an electric fire that had been placed on a chair. Evidence was given that the insulation of the flexible lead, plugged into the lighting fitting in the ceiling, had deteriorated and the copper conductor made contact with the fire. A doctor expressed the view that death was instantaneous ; artificial respiration was tried for a long time and oxygen administered. A verdict of " Death by misadventure" was recorded.

A radio operator, James Greenhill (29), met his death in similar circumstances while having a bath at the Earl Grey Dock gatehouse, Dundee Harbour. In this case a three-bar electric fire standing on a draining board at the end of the bath is stated to have fallen into the water. Artificial respiration was tried for two hours at Dundee Infirmary without success.

Manufacturers' Activities—III

Bruce Peebles' Water-Power and Other Plant

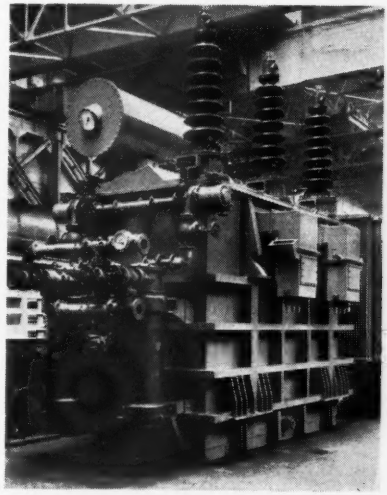
HYDRO-ELECTRIC plant for use at home and abroad and contracts for generating plant up to 24,700 kVA, transformers up to 75,000 kVA, rectifiers up to 2,500 kW and motors of many types and sizes kept Bruce Peebles & Co., Ltd., busy during 1950.

The first 13,333 kVA vertical generator of the North of Scotland Hydro-Electric Board's most northerly major scheme went into service with a 20,000 kVA, 132 kV transformer at the Grudie Bridge power station of the Fannich scheme, Ross-shire, in November while a second similar combination was expected to be in operation by the middle of December. Seven 1,250 kVA diesel-engine generators, also for the Board, were completed for various schemes in the Scottish Highlands where water power cannot be made available. Several complete hydro-electric plants are in hand in units up to 24,700 kVA for the Highlands, some of which carry responsibility for the whole of the work on both the electrical and hydraulic sides. Shipments overseas of hydro-electric generators included machines of 5,312 kVA and 2,600 kVA for Norway. Similar machines now in hand for overseas include: two 11,111 kVA generators, 15,000 kVA and 10,000 kVA synchronous condensers, for New Zealand; two 1,875 kVA generators for Canada; two 957 kVA units for South Africa; two 14,000 kVA, two 5,200 kVA, a 4,300 kVA, a 3,000 kVA and several of smaller output will all go to Norway. Geared steam turbine and engine generators of from 3,125 kVA down to 100 kVA have been completed, or are in hand, for installation at home and abroad.

In addition to the motors made for home industrial purposes and for mines, important quantities have been sent overseas, particularly the flameproof type for oil works. A significant increase has been noted in orders for synchronous induction motors up to 2,250 b.h.p. and for large squirrel cage motors up to 2,050 b.h.p.—many for operating at 6,600 V—for starting at full voltage without the use of compensator or other current reducing devices.

Among contracts in hand for converting plant are: nineteen 2,500 kW 1,500 V d.c. mercury arc rectifier equipments for railway electrification; two 1,000 kW glass bulb rectifiers for the Edinburgh Transport Dept.; 2,500 kW and 1,500 kW motor-convertors and a 1,500 kW motor generator for India. An open-cast coal mining concern ordered a 1,500 kW induction type frequency booster for the supply of power to a large American excavator, to change the existing 50 c/s 3,300-V supply to 60 c/s 4,160 V to suit the excavator's motors. The set will consist of a squirrel cage induction motor directly coupled to a frequency booster having a slip-ring rotor specially insulated; 345 b.h.p. will be delivered as mechanical energy from the motor shaft and 1,250 kW as electrical energy to the booster rotor. The large

20,000 kVA 132/11 kV three-phase water-cooled transformer, one of two for the Loch Fannich, Scotland, hydro-electric scheme



proportion of energy dealt with by one machine (five-sixths of the output) results in a much higher efficiency than would be possible with the conventional frequency changer consisting of two machines converting the total power required.

A three-phase oil-immersed reactor capable of dealing with a power fault of 400,000 kVA at 11,000 V was made for the North of Scotland Hydro-Electric Board.

Orders for transformers covered a wide range from several thousands of small units for wireless transmitters up to large power transformers for the grid, and the volume of work now in hand reaches the total of 1,500,000 kVA. In addition to the usual ranges notable new orders from the B.E.A. were for four 30,000 kVA, ten 10,000 kVA and over 30,000 kVA in sizes from 7,500 down to 10 kVA; from the North of Scotland Hydro-Electric Board for 30,000 kVA and 15,000 kVA units, and for 20,000 kVA in sizes from 3,500 kVA down to the smallest pole mounting transformer. Mobile transformers for the mines continued in good demand. Among direct export orders were seven 3,333 kVA and four 3,000 kVA transformers along with numbers of smaller units for Canada. Various sizes of distribution transformers were ordered from Australia, South Africa, Uganda, India and Iraq.

Hackbridge Rectifiers and Transformers

LAST year was an exceptionally busy one for the Hackbridge & Hewittic Electric Co., Ltd., during which it was reaping the benefit of extensions to the factory, culminating in the production of transformers having an aggregate capacity of well over a million kVA. The larger ones despatched included two of the three 70,000 kVA three phase type OFW generator transformers for Skelton Grange power station (B.E.A. Yorkshire Division) which have the unusual feature of single core cable sealing ends for the 134 kV outgoing connections, instead of the more usual h.v. porcelain bushings. The three cable sealing ends are mounted on the transformer cover at right angles on separate disconnecting chambers, the latter enabling independent cable testing. On-load tap changing equipment of the reactor type gives voltage variation of plus and minus 10 per cent in 14 equal steps. The weight of each transformer complete with oil and including the on-load tap changing equipment, water coolers and oil pumps is 117 tons. The overall height is 25ft. In addition, at Skelton Grange there have been installed this year two Hackbridge naturally cooled 10,000 kVA three phase 132/3 kV station transformers.

Others despatched included two of 60,000 kVA three phase, type ON/OFB, to Huncoat station (B.E.A. North Western Division), the first of two 37,500 kVA units for Ballylumford, N. Ireland, three of the four 34,000 kVA generator transformers for the B.E.A. station at Blackwall Point and one of 30,000 kVA for Finchley (B.E.A. Eastern Division), while the East Midlands Electricity Board (Leicester Sub-Area) has had two of 20,000 kVA with, in addition to the usual accessories, a 33 kV isolating and testing switch complete with a neon device to indicate when the transformer is alive.

Overseas contracts completed included four 20,000 kVA three phase 100/6·6 kV transformers for India, outdoor units specially designed to withstand scorching sun and the torrential rainfall of the monsoon period. The transmission system is in an area subject to lightning storms. A large proportion of the increased output of small and medium size transformers was despatched overseas.

In addition to the increasing demand for Hewittic rectifiers for the operation of heavy d.c. driven machinery in steel works and other engineering plants, 1950 witnessed the completion of a large overseas contract which involved the installation of 26,000 kW of rectifiers in banks of up to 5,000 kW to supply a d.c. network.

Many have also been supplied for both home and overseas traction service. A 500 kW grid controlled rectifier installed in the U.S.A. takes a 4,160 V three phase 60 c/s input and provides an output of 770 A for forming electrolytic capacitors; it is rated at 100 per cent full load continuously and is assembled in two cubicles, one being ventilated and containing the rectifier bulbs and auxiliary gear, and the other being totally sealed and containing the enclosed air cooled transformer and

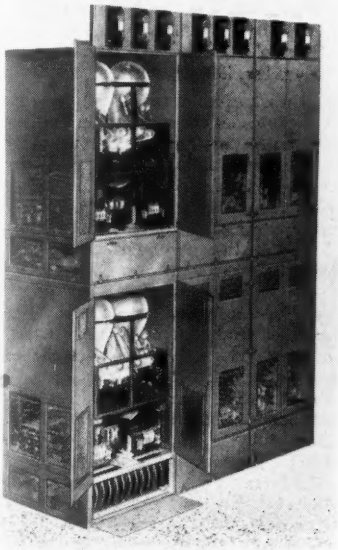
other coil units. Transformer cooling is by means of a fan cooled " air to air " heat exchanger through which the air within the transformer cubicle is circulated by a second fan. The internal air movement is in a completely closed circuit, the air being directed constantly by means of baffles through the transformer coils and windings.

The cooling apparatus is between the two cubicles, as are the electronic grid impulse generating unit, the local control panel and a compartment containing the anode reactors. Supplied with the equipment, but mounted remotely from the rectifier, is a panel with main d.c. circuit breaker, d.c. isolating switch, remote meters, control gear and indicators.

Notable in 1950 was the increasing demand for the " Velotrol " conversion equipment for variable speed motor drives. It is a development of the Hewittic glass bulb rectifier and comprises the normal transformer and rectifier, together with control gear; by manual or automatic operation it enables the armature voltage and field current of shunt connected d.c. motors to be varied either independently or together to give smooth speed variation over ranges of up to 50 : 1 or greater if required.

In the final stages of assembly is one of a range of group unit type equipments designed so that four heavy duty 3-arm bulbs are housed in a single cubicle, which reduces the occupied floor area. It is the result of development during the 40 years since Peter Cooper Hewitt invented the glass bulb mercury arc rectifier and will be on show at the Festival of Britain.

Three-wire 1,700 kW Hewittic rectifiers in grouped bulb cubicle arrangement, three in line in double tier, for use where floor area is limited



Fire Resistance of Cables

A SPECIAL investigation has recently been carried out for the British Plastics Federation at the Fire Research Station of the D.S.I.R. and Fire Officers' Committee Joint Fire Research Organization, to compare the flame-retardant properties of plastic-insulated and rubber-insulated cables. A report on this work has now been published, by permission of the Director of Fire Research, by the British Plastics Federation, 47–48, Piccadilly, London, W.1, price 2s 6d.

This report sets out details of a comparison of the flame-retardant properties of the cables in two cases : where an external source of heat is applied, and where an overload current is applied. The first part of the investigation relating to the application of an external source of heat was carried out substantially in accordance with the test specified by the Underwriters' Laboratories, Inc., of America, in their " Standard for Thermo-Plastic Insulated Wires " (2nd Edition—March, 1945). It was shown that plastic-insulated cables of the types tested have a greatly superior resistance to external heating than have corresponding rubber-insulated cables.

The second part of the investigation, in which an overload of twelve times the rated current capacity was applied, showed generally that the rate of heating was small compared with that in the first part of the experiment. It was sufficient, however, to shrivel the plastics and melt the rubber, although no fire was caused. The breakdown of the insulation in both cases introduced a possible " shorting " hazard.

The cables tested in the first part of the investigation comprised 20in lengths of 7/·029 twin flat plus E.C.C., 3/·029 twin flat, 7/·029 single 40/36 three core and 19/·064 single. Rubber insulation for these sizes was compared with p.v.c. and polythene insulation on cables of similar size. In the second part of the test two types of cable were examined; 40/36 rubber covered, and 18 s.w.g. copper p.v.c. insulated, the specimens being cut to 20in lengths as in the first part.

NEW BOOKS

Primary Batteries. By G. W. Vinal. Pp. 336 ; figs. 101 ; index. Chapman & Hall. Ltd., 37, Essex Street, London, W.C.2. Price 40s in U.K.

This book is a landmark in the bibliography of primary batteries and is the product of a distinguished man who, for over 25 years, has been Chief of the Electro-chemical Division, National Bureau of Standards, U.S.A.

Works chemists to battery manufacturers will appreciate the very thorough treatment and references. The scope embraces the usual dry cells, as well as the modern silver oxide, mercury oxide, perchloric acid and fluoboric acid batteries. Perhaps the most interesting chapter is that dealing with materials and production of dry cells ; the impact of modern tools, i.e., electron microscope and X-ray and mass spectrographs, in improving the manufacture and life of the common dry cell. Practical detailed information is given on modern industrial and military requirements for low temperature batteries, batteries with high energy to weight ratios, etc.

Measurement engineers will find the chapter on standard cells worthy of their attention. Methods of manufacture and test are given, together with a large section dealing with possible errors in the constancy of output of the Weston cadmium cell.

In general, while the proper emphasis is clearly placed on precisely stated chemical principles, the work is so carefully written that its use will be easily realized by many others than trained chemists.—R. C. L.

Matrix Analysis of Electric Networks. By P. Le. Corbeiller. Pp. 112 ; figs. 49 ; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 24s in U.K.

Matrix and tensor analysis of electric networks are not everyday tools of the average electrical engineer and this is no doubt due to the rather involved mathematical theory with which they are usually associated. In this book the author has presented the essentials of matrix analysis as developed by Gabriel Kron and applied to the analysis of stationary electric networks. Any mathematics necessary to an understanding of the book is reviewed in the opening chapter which gives the reader a clear account of matrix algebra and makes mention of the two fundamental topologic equations which are of importance in network analysis.

In order to keep the text of the monograph concise all the proofs in the opening chapter are given in general terms and any reader who is encountering matrix algebra for the first time would be well advised to work out a few numerical exercises. Chapter II is devoted to a derivation of Kron's mesh-method formulæ as applied to both symmetric and asymmetric couplings. Chapter III shows the reader how to analyse a network on a node-pair basis while the fourth and final chapter deals with networks containing both voltage and current sources connected in the most general way to branches likewise coupled in the most general way.

This book is the first in the "Harvard Monographs in Applied Science" series and can be thoroughly recommended to any mathematically minded electrical engineer who is interested in this method of network analysis, and whose mathematical ability is up to the standard of a normal engineering degree. It is unfortunate, however, that the price of this book has been inflated by the present rate of exchange.—C. M. B.

Les Machines Electriques de Réseaux: Transformateurs Statiques, Alternateurs Synchrones. By R. Langlois Berthelot. Pp. 267; figs. 180; index. Eyrolles Editeur, Paris.

This work gives a very good presentation of the problems encountered in transformer design and operation. The concept of per cent reactance is introduced early in the book and is demonstrated by numerous worked examples. Questions of neutral earthing are next considered and various high voltage tests are mentioned. The production of harmonics in transformers is studied; a section on the effect of various three phase connections on the harmonic content of load and circulating currents is well presented, as is a detailed chapter on induction regulators.

The second section of the book deals with synchronous alternators, attention being paid to the stability of machines operating in parallel. Response speed of alternators and various forms of exciters in voltage controlled systems are discussed and the final section of the book brings up questions of power system stability.—G. M. E.

ELECTRICITY SUPPLY

B.E.A. Contracts

South Western Change-Over

DURING the past month the British Electricity Authority has placed contracts for equipment for power stations and transforming stations, and transmission lines amounting in the aggregate to £6,802,978. The principal contracts include:—Tilbury power station: Main transformers and accessories (English Electric Co.). Barking "C" station: 132 kV switchhouse and associated civil works (Sir Robert McAlpine & Sons). Drakelow station (near Burton-on-Trent): Foundations and superstructure (Sir Robert McAlpine & Sons (Midlands), Ltd.). Thornhill station (near Dewsbury): Coal handling plant (Richard Sutcliffe, Ltd.). Connah's Quay station (Chester): Foundations, permanent roads, etc. (Yorkshire Hennebique Contracting Co., Ltd.); structural steelwork (Francis Morton & Co., Ltd.); railway sidings (Summerson & Sons, Ltd.); and two 30 MW turbo-alternator sets (C. A Parsons & Co.). Rye House station, Herts: Works power switchgear (British Thomson-Houston Co.). Bold station (near St. Helens, Lancs): Ash and dust handling plant (B.V.C. Industrial Constructions, Ltd.). Keadby station (near Stoke-on-Trent): Three 60 MW turbo-alternator sets (C. A. Parsons & Co.). Skelton Grange station (Leeds): Two 60 MW turbo-alternator sets (C. A. Parsons & Co.). Westwood station (Wigan): Building work (Wm. Moss & Sons, Ltd.). Carmarthen and Haverfordwest substation: Two 30 MVA 132/33 kV transformers and earthing transformers (Hackbridge & Hewittic Electric Co.). Telford Road and Gorgie substations (Edinburgh): Two 60 MW 132/33 kV transformers and earthing transformers (Metropolitan-Vickers Electrical Co.).

Electricity Output in 1950

In the weekly statement of the Ministry of Fuel and Power it is shown that electricity sent out for public supply from solid fuel fired stations in the week ended 29th December last amounted to 1,100·7 million kWh, as compared with 1,315·6 million kWh for the preceding week and 848·8 million kWh for the week ended 30th December, 1949. The total for 1950 was 50,117·2 million kWh, as compared with 44,869·6 million kWh for 1949.

Proposed Marchwood Station

The Southampton Harbour Board has approved in principle the proposal of the B.E.A. to build a power station at Marchwood. The approval is subject to consideration of the final plans and to any requirements of shipping companies and other users of the port.

Plymouth Illuminations Contract

Approval was recently given for the expenditure by the Plymouth City Council's Parks Committee of £6,350 upon illuminations during the Festival of Britain. The Committee recommended the acceptance of a tender of this amount from the South Western Electricity Board but the Council rejected the recommendation and decided that the contract should be put out to public tender.

South Western Rural Supplies

At a meeting of the Somerset County Executive of the National Farmers' Union at Taunton last week, Mr. J. T. Beresford said the rate of electrification of the countryside in the last year by the South Western Electricity Board was nearly three farms a day, which was quite a good record in view of all the circumstances in which the Board operated. He was afraid, however, that farmers must resign themselves to "cups falling off cows at 4 o'clock" for many years ahead.

The South Western Board has recently completed the conversion of the supply system at Polruan, Cornwall, from d.c. to a.c., and the village now has a mains supply. Difficulties with the d.c. supply given by the former non-statutory undertaking led inhabitants to make representations, through the Consultative Council, to be provided with a supply by the Board and an agreement was negotiated by the Board and the owner of the Polruan undertaking. The change-over was carried out within a week. Altogether 334 consumers have been connected and at the change-over there was an immediate four-fold increase in the number of cookers installed. A new street lighting system has been put into operation by the Board. No attempt is being made to develop the water heating load until the Liskeard Rural District Council's new scheme for an improved water supply system is completed.

Scottish Farm Electrification

Policy of the Electricity Boards towards prospective farm consumers has been clarified in Scotland. In South West Scotland it has been recently arranged that farms can be

connected at a cost of £100, subject to a sufficient grouping of consumers in an area. The South East Scotland Board has pointed out that farms in its area are more widely distributed and the cost of taking power is in the region of £1,000 per farm against the average cost of £400 per farm in West Scotland. Normal policy is to ask the farmer to contribute one quarter of the installation cost.

New Shawinigan Undertaking

On 14th December Mr. Maurice Duplessis, Premier of Quebec, inaugurated the great Trenche hydro-electric development of the Shawinigan Water and Power Co. From the Provincial Government buildings in Quebec City, the Premier gave the signal to start the first of five 65,000 h.p. generators. The second set is to follow almost immediately and the others should be in service by the summer.

Lighting in Northern Ireland

The latest street lighting installation by Siemens Electric Lamps & Supplies, Ltd., comprises 169 Class A "Wilton Sieray" fluorescent lanterns at Newtownards, Northern Ireland. This town is about ten miles from Belfast and is the junction for the Ards Peninsula traffic. The columns were manufactured by Concrete Utilities, Ltd., in Hilton red sand, and incorporate a special fluorescent lantern head. All the control gear is fitted in the end of the lantern which recesses into the concrete pole head, being secured by four heavy bolts. The roof of the lantern is supported by a special internal bracket which carries the reflectors, the whole being enclosed by a one-piece "Perspex" bowl. Access for re-lamping is simplified by a single heavy duty knurled nut.

In addition to the Class A lighting the Class B roads are illuminated by 325 80W "Sieray" MB/V lamps mounted on wall brackets, overhead line poles and concrete columns.

This installation was switched on by Alderman Isaac Baxter in the presence of Northern Ireland Government officials on 15th December. Erecon, Ltd., were sub-contractors to Siemens Electric Lamps & Supplies, Ltd., for erection work, which was completed in eight weeks.

"Cuts" and Cookers

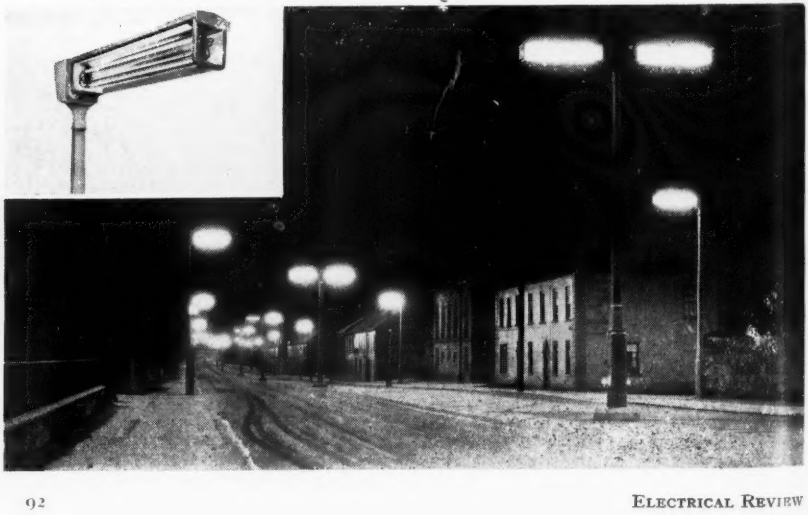
Following complaints of electricity cuts received by the Skipton Rural Council Housing Committee from tenants of Council houses provided with electric cookers, the desirability of providing alternative cooking facilities was raised. The Council has decided that so long as present conditions prevail it will suspend the installation of electric cookers in parishes where alternative facilities are available.

Electricity but no Refrigerators

Although Sowerby Bridge Council is proposing to install electricity in seventy-five Council houses which were built before the war, it has been decided to drop the plan to provide refrigerators for local Council houses, a questionnaire having revealed that few tenants desired them.

Nationalization in Syria

The Syrian cabinet has decided to nationalize all electricity companies and electric transport in the country. All the companies concerned are foreign.—*Reuter* (Damascus.)



Newtownards, N. Ireland, street lighting. (Inset) "Wilton Sieray" fluorescent lantern showing method of attachment to pole head

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

"Foster Mother" for Pigs

Nine piglets are apparently the maximum which a sow can feed if they are to develop properly and if the sow herself is not to suffer. To feed larger litters and also litters of sows which suddenly go dry, Arnold & Sons, 54, Wigmore Street, London, W.1, have brought out an electric "foster mother," comprising a cylindrical vessel with a capacity of about

Arnold electric "foster mother"

one gallon and fitted with an immersion heater. At regular intervals round the base are nine nozzles, on which are fitted renewable rubber teats with special holes to prevent leakage when not in use.

For use, the milk is first heated to a temperature of just over 110 deg F and poured into the foster mother, which is then placed in the sty and plugged in. The immersion heater will then maintain the correct temperature within narrow limits. It is left switched on while the pigs are feeding and sustains no damage through being left on after all the milk has been drained off. Twenty-four hours' use costs less than one penny. The price of the apparatus is £6.

Fume Extractor

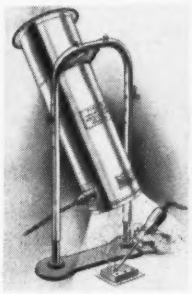
A method of diverting fumes which are generated in close proximity to the worker in industrial processes such as soldering and brazing, has been devised by the ACRU ELECTRIC TOOL MANUFACTURING CO., LTD., 123, Hyde Road, Ardwick, Manchester, 12, utilizing the heat emission of the lamp which illuminates the work-bench. This "Pyrobit" fume extractor comprises an air duct and an electric lamp which provides the light and at the same time the necessary heat to create a chimney effect capable of withdrawing fumes from the work and dispersing them above the worker's head.

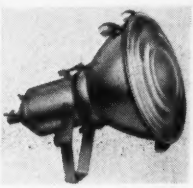
It stands on its own base or may be screwed to the bench or wall. The height or angle of the funnel can be adjusted to suit any kind of work up to 2ft high. The funnel is 24in long and 6in in diameter. The complete appliance, including 6ft of 3-score cable weighs 11 lb and is priced at £14 with a stainless steel funnel, or £9 10s with an aluminium funnel. Special lamps cost 7s 6d extra but standard 60 or 100 W lamps may be used.

Flood Lanterns

A range of general purpose "Festival" flood lanterns introduced by ROWLANDS ELECTRICAL ACCESSORIES, LTD., R.E.A.L. Works, Hockley Hill, Birmingham, 18, is a development of the original "Jubilee" range. The lanterns are built to withstand severe weather conditions, and it is claimed that their cost is below the normal hire charges for standard equipment of similar size.

The bodies and reflectors are produced from medium gauge steel treated to withstand corrosion and the heavy moulded (heat-resisting) front glass is permanently rolled into position at the mouth of the reflector. The lantern breaks at the neck for re-lamping, the reflector portion being secured to the body by means of brass toggle bolts and engaging on a rubber gasket. The 200 W size is supplied complete with a focusing device but no focusing is





Left: "Pyrobit" fume extractor. Below: R.E.A.L. "Festival" flood lantern

necessary for the 100 W and 150 W models. A further model of generally similar construction is available for 300–500 W lamps.

Double-Pointed Iron

The new "Mary Ann" iron brought out by THORN ELECTRICAL INDUSTRIES, LTD., 105-9, Judd Street, London, W.C.1, besides retaining the useful feature of being double-pointed, includes a pilot lamp and an improved handle which can be removed and replaced within thirty seconds. Removing the handle gives easy access both to the pilot lamp and the mains lead terminations. Another feature facilitating servicing is a unified thermostat assembly mounted on the pressure plate which can be easily removed, complete with element, without disturbing the thermostat settings. The iron is finished in vitreous enamel, weighs 5 lb and is loaded at 750 W. The price is 39s 6d for the a.c. model and 42s for the a.c./d.c. model.

"Mary Ann" iron

Induction Heating Equipment

A 2 kW r.f. induction heating unit (Model K.2.E.) which has just gone into production at the works of SIMMONDS BROS., Bedcote Mill, Stourbridge, Worcs, employs a Colpitts oscillator circuit with a transformer coupled work circuit designed to cover a wide range of loads. The h.v. supply is derived from a three-phase bridge rectifier, and provision is made for automatic reduction of oscillator filament temperature when off load.

The nominal frequency and optimum load "Q" can be varied to suit individual requirements; all r.f. circuits are in a screened compartment in order to prevent radiation. The process timer is synchronous and may be locked; the normal maximum setting is 100 sec.

As standard the machine is built for a three-phase supply, but single-phase equipment can be supplied if required. The equipment is robustly made, weighs approximately 4 cwt, and is mounted on swivel castors; the interior is dust-screened and fan-cooled.

The company's aim in introducing this unit is to provide an easily installed, readily serviceable, and simple to operate machine as a basic design of convenient size for tool-room, general workshop, and production applications: to be supported by service in the design and production of work-coil units and transformer couplers to meet particular requirements.

Heat Controlled Iron

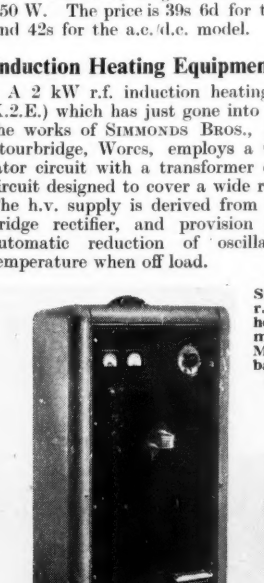
The "Nine-O-Nine" automatic heat controlled iron made by PREMIER ELECTRIC HEATERS, LTD., Keeley Street and St. Andrews Road, Birmingham, 9, is an improved version of the "Eight-O-Eight" which has been on the market for the past ten years. It retains the streamlined appearance and chromium plated finish but is fitted with a preset thermostat which will make servicing very much easier. It is suitable for a.c. circuits only and is made for 110/120 V, 200/220 V and 230/250 V ranges. Consumption is 800 W on 100/120 V and 1,000 W on the higher voltages.

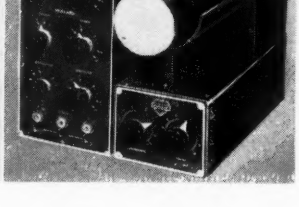
Educational Aid

A cathode ray tube unit, with an associated time base amplifier unit, has been introduced by MULLARD ELECTRONIC PRODUCTS, LTD., Century House, Shaftesbury Avenue, London, W.C.2, to meet the needs of educational establishments where a moderately priced instrument is required for the demonstration of a.c. theory and the various applications of cathode ray oscillography in modern research.

Among the demonstrations that can be made are half- and full-wave rectification, magnetic hysteresis, harmonics, frequency determination, Lissajou figures, smoothing, etc. It can also be used for a variety of tests in the laboratory, and the amplifier section may be employed as a general-purpose voltage amplifier without modification.

The cathode ray tube unit is a simple instrument with its own supply unit and embodies a 3in tube, which is exposed so that the effects of magnetic deflection can be demonstrated.





Simmonds 2 kW r.f. induction heating equipment and (below) Mullard time base amplifier and c.r.t. unit

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Turner & Newall, Ltd., report a consolidated net profit, before tax, for the year to 30th September last, of £7,154,468, as compared with £6,274,079 for the previous year. The balance attributable to interests of Turner & Newall is £3,086,499, less £450,376 carried forward by subsidiaries. Of this £1,000,000 is placed to reserve for replacement of fixed assets, and £250,000 is applied to writing down value of investments in subsidiaries trading overseas. The ordinary dividend for the year is 17½ per cent (against 15 per cent), and in addition this year a special bonus of 2½ per cent is paid. General reserve receives £500,000, and £1,075,864 is carried forward (against £852,592 brought in).

Radio Rentals, Ltd., in a preliminary statement, shows net profits for the year ended 31st August last of £153,256, as compared with £138,654 for the preceding year. Consolidated net profits of the group have increased from £150,162 to £171,952. It is proposed to pay a final ordinary dividend of 20 per cent, making 30 per cent for the year (against 25 per cent).

Worthington-Simpson, Ltd., has declared an interim dividend of 10 per cent on £480,000 ordinary. This compares with an interim of 10 per cent on £320,000 in the previous year. On 30th November last a 50 per cent scrip bonus was approved.

Tube Investments, Ltd., announces that the offer to shareholders of 5,000,000 4½ per cent cumulative redeemable preference shares of £1 each at par has been heavily oversubscribed.

Enfield Cables, Ltd.—It is reported that preliminary arrangements are being made by the directors for an issue of £1,500,000 of debentures. A meeting of the 7½ per cent preference shareholders has been called to secure their consent to the borrowing.

Hackbridge Cable Holdings, Ltd., has declared an interim dividend of 7½ per cent (unchanged).

Greenwood & Batley Ltd., are again paying an interim dividend of 5 per cent.

Brown Bros., Ltd., have obtained Treasury consent to the issue to existing shareholders of 217,920 new £1 ordinary shares, at 30s each, in the proportion of one new share to five already held.

New Companies

Lancashire Dynamo & Crypto (Mfg.), Ltd.—Registered 1st January. Capital £100,000. To acquire a four-fifths share in the business of mechanical, electrical and hydraulic engineers, manufacturers of and dealers in machinery, toolmakers, boiler makers, and steel, iron and brass founders, carried on by Lancashire Dynamo Holdings, Ltd.; to carry on the said business in partnership with that company; and in the event of the determination of the partnership to acquire the one-fifth share of Lancashire Dynamo Holdings, Ltd., or to sell the four-fifths share of this company, as provided for in a deed of partnership. Directors: H. W. Bosworth, F. H. Schroeder, D. C. Lorkin and A. W. A. Dick-Cleland (all directors of Lancashire Dynamo & Crypto, Ltd., etc.). Secretary: N. T. Hodgkinson. Regd. office: 94, Petty France, Westminster, S.W.1.

Reference to this company was made in "Commerce & Industry" in our last week's issue.

Phillips & Co. (Flore), Ltd.—Registered 1st January. Capital £2,500. To acquire the business of an electrical engineer carried on by Lewis S. Phillips at Flore, Northants. Directors: L. S. Phillips, W. H. Hamilton and L. W. Phillips. Solicitors: Shoosmiths & Harrison, 20, Market Square, Northampton.

T. & A. Nixon, Ltd.—Registered 30th December. Capital £3,000. Electrical engineers, electrical installation contractors, etc. Directors: W. A. Swaithes and Elsie Swaithes. Registered office: 409, Stockport Road, Timperley, Cheshire.

B.C. Electrical Techniques, Ltd.—Registered 30th December. Capital £500. Development of electrical, mechanical and electro-mechanical devices, tools and equipment, etc. Directors: J. D. Stalker and D. P. Joyce. Regd. office: 50, Islington Park Street, Islington, N.1.

Stevenage Switches, Ltd.—Registered 30th December. Capital £100. Manufacturers of and dealers in electrical, electronic and scientific instruments and component parts, etc. Directors: P. L. Wilde, I. C. M. Worsfold, W. H. T. Hayward, L. T. Taylor, A. P. G. Amos and C. Wallis. Secretary: L. T. Taylor.

Con-Electric, Ltd.—Registered 29th December. Capital £5,000. Electricians, mechanical engineers, etc. Directors : W. S. Earle, J. W. Woods, G. Dew, J. Helmes, T. Wilkinson and A. Lee. Regd. office : Prospect House, Main Road, Oldham.

Bernard Berrie (Newcastle), Ltd.—Registered 1st January. Capital £3,000. To acquire the business of an electrical contractor carried on by B. Berrie at Corporation Street, Newcastle-on-Tyne. Directors : B. A. Berrie and Mrs. D. Berrie. Regd. office : 39/43, Corporation Street, Newcastle-on-Tyne, 1.

Blagbrough & Hebblethwaite, Ltd.—Registered 19th December. Capital £5,000. To acquire the business of electricians, electrical contractors, wireless and television engineers and garage proprietors carried on by H. Blagbrough and A. W. Hebblethwaite at Bank Top, Southowram, Halifax, as Blagbrough and Hebblethwaite. Directors : H. Blagbrough and A. W. Hebblethwaite. Regd. office : Bank Top Works, Bank Top, Southowram, Halifax.

Hazeltons, Ltd. — Registered 21st December. Capital £10,000. To acquire the business of a dealer in electrical goods now carried on by F. W. Hazelton at 92, King's Avenue, Holland on Sea ; Century Buildings, Pier Avenue, Clacton-on-Sea ; and 4, Connaught Avenue, Frinton-on-Sea, Essex as F. W. Hazelton. Directors : F. W. Hazelton, F. W. Hyde, R. F. Howard and G. M. Hazelton. Regd. office : 92, King's Avenue, Holland on Sea, Essex.

Lumi-Neon Signs (London), Ltd.—Registered 19th December. Capital £1,000. Manufacturers, importers and exporters, fitters and repairers of and wholesale and retail dealers in electrical and neon signs, electric light fittings, etc. Directors : J. Balzano and P. D. Hay. Regd. office : 59, Annesley Avenue, N.W.9.

Ambrose & Albrow, Ltd.—Registered 19th December. Capital £2,000. Electricians, electrical engineers and agents for and dealers in radio, television and electrical apparatus, etc. Directors : I. M. A. Matheson, E. W. A. Ambrose and R. B. Albrow. Regd. office : 51, High Street, Sittingbourne, Kent.

Liquidations

H. Lawrence Electrical, Ltd. (in voluntary liquidation).—Meetings of members and creditors to-day (Friday) at St. Stephen's Chambers, Telegraph Street, Moorgate, London, E.C.2.

D.B.H. Engineers, Ltd.—Mr. N. W. Osborne, 11-12 Finsbury Square, London, E.C.2, appointed liquidator, with a committee of inspection, 12th December.

M. Allen (Radio), Ltd.—Mr. J. S. Bradley-Hole, 240, High Holborn, London, W.C.1, appointed liquidator with a committee of inspection, 4th December.

Medcalfe & Co., Ltd.—Mr. J. W. Clement, 59, New Cavendish Street, London, W.1, appointed liquidator, with a committee of inspection, 12th December.

Bankruptcies

E. W. Thorne, Blackamoor Lane, Maidenhead, plumbing and electrical engineer.—Receiving order made 2nd January on debtor's own petition.

L. G. Sharp, 4, Summerleys Road, Princes Risborough, electrician.—First meeting 19th January at 3, Central Buildings, Matthew Parker Street, London, S.W.1. Public examination 22nd February at the County Hall, Aylesbury.

J. Shelvey, carrying on business as "Vesta-Shelvey Electrical Installations" at Vesta Manufacturing Works, L.M.S. Goods Dept., Oakengates, Salop.—First meeting 13th January at the Official Receiver's Office, 12, Lonsdale Street, Stoke-on-Trent. Public examination 13th February at the Shire Hall, Shrewsbury.

L. L. O'Connor, 27, Wellington Square, London, S.W.3, electrical engineer, trading as "Paragon Electrical," electrical and radio contractor.—Application for discharge to be heard on 9th February at Bankruptcy Buildings, Carey Street, London, W.C.2.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered within a month of 27th December.

SCALEX. No. 640,473, Class 7. Electric motors (not for land vehicles), concrete mixing machines, etc.—Scalex Aktieselskab, Copenhagen. Address for service, c/o W. P. Thompson & Co., 12, Church Street, Liverpool, 1.

ANSIFLOW. No. 692,661, Class 7. Welding machines, electric motors (not for land vehicles), electricity generators and parts of, and fittings included in Class 7.—L'Air Liquide Société Anonyme pour l'Etude et l'Exploitation des Procédes Georges Claude, Paris. Address for service, c/o Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

MARY ANN. No. 692,872, Class 7. Ironing, washing, wringing, combined washing and drying machines, machines for peeling and slicing vegetables, cream-and-egg-whisking machines and mixing machines, all being electrical goods.—Thorn Electrical Industries, Ltd., 105 to 109, Judd Street, London, W.C.1.

PRESTIGE. No. 688,889, Class 9. Electrical apparatus included in Class 9 and scales, all for domestic or household purposes. No. 688,890, Class 11. Electrical apparatus included in Class 11 for heating, cooking and refrigerating, all for domestic or household purposes.—Platers & Stampers, Ltd., Colne Road, Burnley, Lancs.

HYDRA. No. 690,646, Class 9. Electric cables and electric flexibles.—Hydran Products, Ltd., Hydra Works, Gresham Road, Staines, Middx.

ASHATHENE. No. 692,505, Class 9. Cables included in Class 9.—Shardlow Electric Wires, Ltd., Moseley Buildings, 56, Moseley Street, Manchester.

STOCKS and SHARES

STOCK Exchange markets started the New Year in good fettle and prices since the end of 1950 have been, generally speaking, on the up-grade. This implies a fairly substantial volume of buying and capital continues to seek the safety of gilt-edged industrial shares, in spite of the uncertainties provided by the prophecies of higher taxation and a penal Budget. On balance, prices are generally higher than they were a fortnight ago and in most of the industrial departments of the Stock Exchange there is a useful volume of business current day by day.

Highs and Lows

By way of a supplement to the tables produced here last week, giving the comparison between share prices at the beginning and end of last year, the following indicates how present share prices of some of the market leaders compare with the highest and lowest recorded over the same period:—

Stock or Share	1950		Now
	High	Low	
3 per cent British Electricity 1974–77 ..	98¼	91⅞	96⅝
A.E.I.	85/–	67/9	83/9
Auto. Telephone	63/3	51/6	62/–
B.I.C.	35/7	29/6	33/6
Brush	7/1	4/9	6/6
Crompton Parkinson ..	12/7	11/1	11/6
Electric Construction ..	62/6	43/6	61/3
E.M.I.	28/6	16/1	21/3
English Electric	18/10	38/6	17/6
G.E.C.	86/–	72/–	82/6
C. A. Parsons	77/–	58/–	76/3
T.C. & M.	43/6	35/3	42/6
Tube Investments ..	6 5/16	5 1/16	6 1/16

Many prices are still close to last year's best level, which was reached, generally, during the autumn, between the original Korea outbreak and its intensification in November. Lowest points were mostly recorded in the first two months of last year

Week's Price Changes

Price movements in electrical stocks and shares during the first week or two of the New Year, show a majority of rises. Thorn Electrical shares stand out at 23s 9d, a gain of 3s 9d. Calcutta Trams at 32s 6d and Vactric at 10s are 5s and 2s 6d higher respectively. Murex, 50s, E. K. Cole, 20s, Pye, 37s 6d, Decca, 14s 6d, Plessey, 17s 6d, show improvements, and Telephone Properties further advanced to 23s 9d. Ever Ready ordinary shares at 28s 6d are 1s up.

On the other hand, Associated Electrical Industries, 83s 9d, have lost 1/16, and small falls occurred in British Vacuum, 9s 6d, Burco, 23s 9d, International Combustion, 15s 9d, and De la Rue, 27s 6d.

New Issues

Following the thoroughgoing simplification of the capital of S. Smith & Son (England) and the capital issues, dealings are now in progress in the new 4s ordinary shares at 2s 3d premium on the offered price of 6s, and in the 5 per cent preference shares at 22s. On the basis of last year's earnings, the 10 per cent dividend indicated by the chairman on the ordinary capital, as reconstructed, should be well within earning capacity. It would show a yield of about £4 17s per cent on the shares at their present price. The Pye Company is holding meetings on the 19th of this month to authorize an increase in capital. The intention is to make a 100 per cent distribution of deferred shares and to offer an issue of preference shares for cash on terms to be decided later.

Rise in Cossor

Rapid appreciation in the price of A.C. Cossor 5s shares, from 9s to 12s, was one of the few lively events in the industrial markets during the closing weeks of the year They have since vacillated between 11s 6d and 12s. Various rumours accompanied the movement, the most persistent being a report of large national defence contracts; another talked vaguely of an early statement concerning preference dividend arrears. The last official news from the company was the postponement of the 6 per cent preference dividend due last September. This left the payments in arrears for two years. The company's year ends in March, and the results appeared last time in September. They showed good progress in retrieving the heavy debits incurred in the preceding year.

London Electric Wire

New shares offered last month to London Electric Wire & Smith's stockholders at £2 per share are quoted at 7s premium on that figure. Allotments can be renounced up to 15th February, when the final call of 20s per share falls due. Until then a buyer can acquire the shares without the expense of the 2 per cent transfer stamp duty. From the 1949 group profit of £320,000 (after tax of nearly £300,000 and the preference dividend), the 10 per cent ordinary dividend took less than £38,000 net. In their statement announcing the new issue, the directors estimated that the 1949 profit will have been substantially exceeded last year. Maintenance of the dividend rate is consequently regarded as a safe assumption. This would mean a yield of £4 6s per cent on the present price of the shares. The new issue ranks for the next dividend, due in May.

NEXT WEEK'S EVENTS

Monday, 15th January

BIRMINGHAM.—Grand Hotel. Birmingham Electric Club. "Electrical Equipment in a Newspaper Office," by F. Raybould.

CARDIFF.—At the South Wales Institute of Engineers, Park Place, 6 p.m. I.E.E. Western Supply Group. "Design of Power Transformers to withstand Surges due to Lightning, with special reference to a New Type of Winding," by A. T. Chadwick, J. M. Ferguson, D. H. Ryder and G. F. Stearn.

CHESTER.—Town Hall, 6.30 p.m. I.E.E. Mersey and North Wales Centre. "Railway Electrification: Design of Overhead Equipment," by F. B. Kitchen and J. Holland.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "Aesthetic Design in Transmission and Distribution Systems, including the Power Station," opened by A. R. Cooper.

St. Ermin's Hotel, S.W.1, 6.50 p.m. A.S.E.E. Central London Branch. "A Camera and the Engineer," by G. E. Whalley.

NEWCASTLE-ON-TYNE.—King's College, 6.15 p.m. I.E.E. North-Eastern Radio and Measurements Group. Informal lecture on "The Operation and Maintenance of Television Outside-Broadcast Equipment," by T. H. Bridgewater.

RUGBY.—E.M.E.B. Showrooms, High Street, 6.30 p.m. I.E.E. Rugby Sub-Centre. "The Performance of the British Grid System in Thunderstorms," by Dr. J. S. Forrest.

STOCKPORT.—White Lion Hotel, Underbank, 8 p.m. A.S.E.E. Stockport Branch. "Electric Traction," by Mr. Kennerley.

STOKE-ON-TRENT.—Electricity Showrooms, 7 p.m. I.E.E. North Staffordshire Sub-Centre. Informal meeting. "Scientific Aids to Production," by H. S. Carnegie.

Tuesday, 16th January

BIRMINGHAM.—Town Hall, 6 p.m. I.E.E. South Midland Centre. Faraday Lecture. "Lamps and Lighting—a Record of Industrial Research," by L. J. Davies.

CAMBRIDGE.—Cavendish Laboratory, 8.15 p.m. I.E.E. Cambridge Radio Group. "The Use of Saturable Reactors as Discharge Devices for Pulse Generators," by W. S. Melville.

HULL.—Y.E.B. Showrooms, Ferensway, 7.30 p.m. I.E.E. North Midland Centre. District meeting. "The Development and Design of Electrical Control Gear for Machine Tools," by A. R. H. Thorne.

LIVERPOOL.—Merseyside and North Wales E.B. Service Centre, Whitechapel, 6 p.m. I.E.S. Liverpool Centre. "Light, Colour and the Stage," by E. Faraday.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurements Section. "The Measurement of Interlaminar Resistance of Varnish-Insulated Silicon-Steel Sheet for Large Electrical Machines," by E. D. Taylor. (To be read by C. C. Giles.) "Relaxation Methods Applied to the Problem of A.C. Magnetization of Ferromagnetic Laminæ," by O. I. Butler and M. R. Sarma.

At the Institution of Mechanical Engineers, Storey's Gate, S.W.1, 5.30 p.m. Institute of Fuel. "The Transport and Storage of Coal," by L. Locket.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Supply Group. "The Planning of an Electricity Board's Distribution System," by G. O. McLean.

Wednesday, 17th January

LONDON.—Savoy Place, W.C.2, 6 p.m. I.E.E. Education Discussion Circle. Discussion on "Electric Wave Filters," opened by F. E. Rogers.

At the Royal Institution, Albemarle Street, W.1, 6 p.m. Illuminating Engineering Society. First Trotter-Paterson Memorial Lecture. "The Early Years of Illuminating Engineering in Great Britain," by Dr. J. W. T. Walsh.

John Adam Street, Adelphi, W.C.2, 2.30 p.m. Royal Society of Arts. Trueman Wood Lecture. "1851–1951: A Century of British Industry," by Lord McGowan.

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. A.S.E.E. Manchester Branch. "Electronics," by J. E. Fielden.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute. I.E.S. Tees-Side Group. "Decorative Lighting," by L. H. Hubble.

SOUTHAMPTON.—University College, 6.30 p.m. I.E.E. Southern Centre. Discussion on "The Development in the Use of Electricity in Southampton Docks since 1910." Opened by E. S. Ely.

Thursday, 18th January

BIRMINGHAM.—Grand Hotel, 8 p.m. I.E.E. South Midland Students' Section. Annual dance.

CHELTENHAM.—Cadena Café, High Street, 6.30 p.m. I.E.S. Gloucester and Cheltenham Centre. "Lighting of Architecture," by G. G. Baines.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Utilization Section. "Electrically Interlocked Guards on Machines," by W. Fordham Cooper.

WOLVERHAMPTON.—M.E.B. Showrooms, Darlington Street, 7 p.m. E.P.E.A. Midland Technical Group. "Supervisory Control."

Friday, 19th January

BIRMINGHAM.—Arden Hotel, 7 p.m. Society of Instrument Technology, Midland Section. "The Time Factor in Temperature Measurement," by E. W. R. Little.

MANCHESTER.—Engineers' Club, Albert Square, 6.45 p.m. Manchester Association of Engineers. "Electrical Aspects of the Manchester-Sheffield Electrification Scheme," by A. G. Hopking, and "The Mechanical Design and Construction of the Manchester-Sheffield-Wath Electrification Scheme," by H. O. Hinchliffe.

Saturday, 20th January

LEEDS.—I.E.E. North Midland Students' Section. Visit to Yorkshire Switchgear and Engineering Co.

The G.E.C.-engined diesel-electric tug *Acklam Cross* towing the unfinished turbo-electric tanker *San Salvador*

Turbo-Electric Tankers

THE *San Salvador* is a turbo-electric tanker of 15,900 tons dead weight carrying capacity, designed for a service speed of 14·75 knots and is in most respects a duplicate of the successful sister ship the *San Silvestre*. Both vessels have single screws driven by 126 r.p.m. 9,000 s.h.p. salient pole marine propulsion motors and single casing G.E.C.-Fraser and Chalmers high-pressure turbines direct coupled to three-phase 3·32 kV alternators. Steam conditions are 475 lb/sq in superheated to 775 deg F.

Just over a year's continuous service of the *San Silvestre* has led to a few improvements in arrangement and layout. None of these has involved much alteration to the main propulsion units, but more space has been provided in the engine room and firing floor.

The speed governing gear of the main propulsion turbine has been improved in performance and security. A new type of emergency overspeed governor has been devised with a better tripping and resetting characteristic. Instead of two tripping governors in parallel a vertical spindle centrifugal governor acts as the first overspeed device by moving an oil pilot valve which admits oil under the governor relay pressure to a piston and displaces the speed governor pilot to close the main steam emergency and throttle valves. Only if this fails does the tripping governing operate. The normal speed control has been improved to eliminate the speed change between no load and full load, by interposing a self restoring pressure relay similar to that used in Fraser and Chalmers pass-out turbines working to hold constant pressure. With this device any particular setting of the speed control gives the same alternator speed whether it is loaded or running light. Sensitivity can be varied to suit the average sea conditions.

The vacuum trip in the *San Silvestre* takes the form of a spring loaded metallic bellows acting direct upon emergency tripping levers. To eliminate frictional effects an oil pilot valve and piston have now been interposed to apply a larger tripping force to these levers. This pilot valve and piston will also trip the emergency gear if the relay oil pressure falls off.

The mixed pressure governing gear on the 400 kW auxiliary turbo generators has been improved with a slight alteration to the control pilot valves. In all circumstances it disposes of surplus l.p. steam not absorbed in the de-aerator and employs it in useful work instead of its being wasted in the main condenser.

The *San Silvestre* was considered remarkable at the time of her announcement for the extent to which use had been made of various means for the recovery of waste heat. In the *San Salvador* further improvements in the disposal of the steam pipe drains have been possible and in general these are taken into the first feed water heater flash box, recovering both heat and distillate.

Automatic valves have been added to the circulating water system of the 400 kW

turbo-generators, to provide water from the main circulating pump delivery. In heavy weather the injection valve sea-water inlets are sometimes uncovered with consequent loss of suction. In spite of this, the new arrangement keeps the auxiliary sets primed and operating.

To cater for additional forced ventilation for tropical conditions, and generally increased load, the 110 V supply has been enlarged; the motor generators are 50 kW sets, instead of 30 kW, and the standby diesel generator is 100 kW instead of 150 kW.

The complete turbo-electric propulsion and engine-room electrical auxiliary equipment, excepting certain special items, have been designed and manufactured by the General Electric Co., Ltd., which has also supplied the all-electric galley.

The *San Salvador* is the latest tanker built by the Furness Shipbuilding Co., Ltd., for the Eagle Oil and Shipping Co., Ltd., to the specifications of its superintendent engineer, Mr. W. C. Nelson, O.B.E.

STEELWORKS LOCOMOTIVES

800 *h.p. Units for Service in Australia*

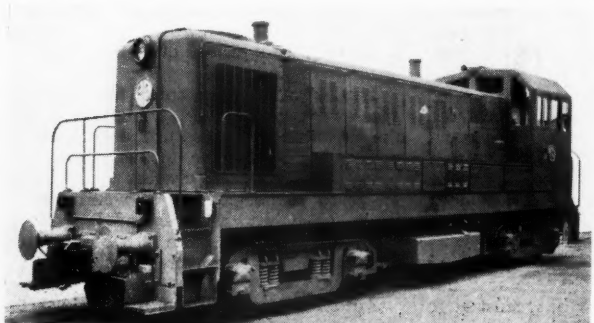
EIGHT 800 h.p. heavy-duty diesel-electric locomotives are now being put into service by the Australian Iron and Steel Co. at its Port Kembla steelworks. The complete power and electrical equipments for these locomotives have been supplied by the English Electric Co., Ltd., the mechanical parts being built by various firms in Australia and assembled by the Commonwealth Engineering Co., to the designs of the Australian Iron and Steel Co. The locomotives are of double-bogie single end cab type and weigh 87 tons.

The power unit of each locomotive comprises an English Electric eight-cylinder diesel engine of 800 b.h.p. at 750 r.p.m. continuous rating directly coupled to the generator. The engine-generator set is mounted on a resilient three-point suspension which prevents distortion of the engine bedplate and also the transmission of vibration from the engine to the underframe.

The main generator is a six-pole self-ventilated d.c. machine, with separately- and self-excited shunt field windings, continuously rated at 450 kW, 600 V, 750 A. The power output is controlled by variation of field strength in conjunction with engine speeds of 450, 620 and 750 r.p.m.

The main generator supplies current to four axle-hung traction motors which drive their respective axles through double reduction spur gearing. The traction motors, which have a one-hour rating of 136 h.p., 400 V, 280 A, are series-wound four-pole machines, force ventilated by a blower mounted on an extension to the 4·7 kW auxiliary generator shaft. The latter is a four-pole shunt-wound machine, belt driven from an extension to the main generator shaft, and supplies current for the control circuits, lighting, battery charging and excitation of the main generator.

These locomotives are giving satisfactory service on arduous duties which include haulage of coal and iron ore trains of up to 1,000 tons gross weight. The coal trains are hauled up to the Port Kembla steelworks from collieries between five and six miles distant over grades as steep as 1 in 70.



One of the eight 800 h.p. English Electric locomotives for steelworks service in Australia

Maintenance more important than ever before !

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MARTINDALE COMMSTONES

● Cut copper, brass and steel without clogging. Edges of every bar left clean; no dragging of copper. Save 75% of time and cost of turning commutator in lathe. Give longer life to motors, etc.

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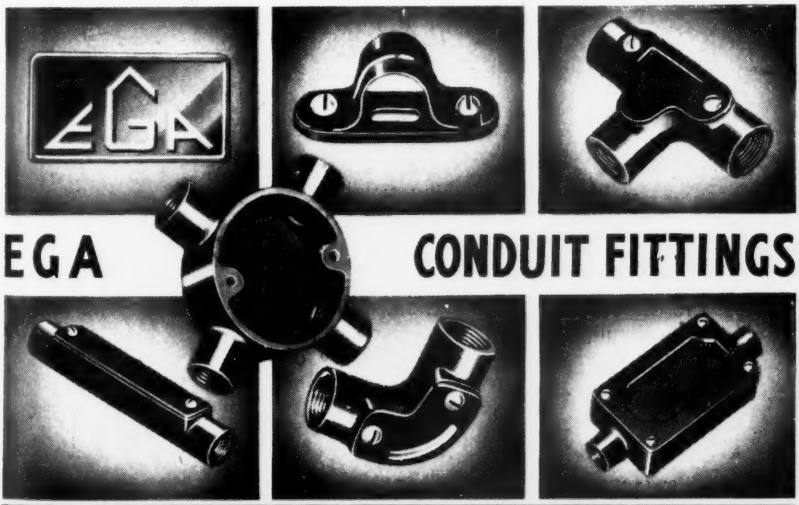

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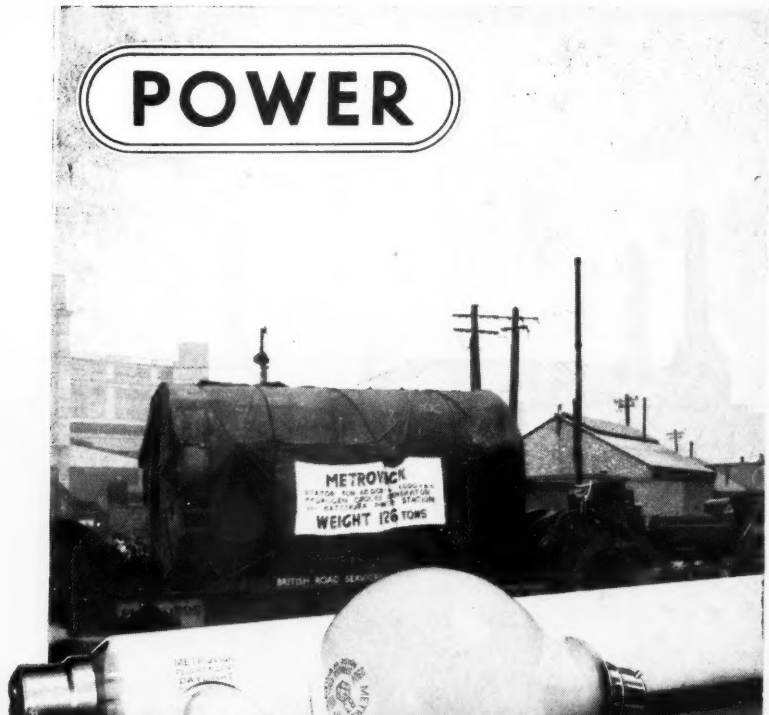

LIGHT

The photograph shows the Metrovick 66,667 kVA Hydrogen-Cooled Generator for the Battersea Power Station. Millions of people depend on Metrovick equipment for their electricity.
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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1948

3[illegible]. Philips Electrical, Ltd.—Manufacture of electrically semi-conductive material. 5th January, 1948. (649935.)

1[illegible]8. British Thomson-Houston Co., Ltd. Gas filled dynamo-electric machines. 14th January, 1948. (649901.)

1283. Compagnie Generale D'Electricite. Electric cable with gas under pressure in the insulating material. 15th January, 1948. (649902.)

1715. General Electric Co., Ltd., and Bryden, J. E. Electrical signalling systems. 20th January, 1949. (649904.)

1720. General Electric Co., Ltd., and Heathcote, V. A. High-frequency oscillators. 19th January, 1949. (649916.)

4838. Guardian Electric Manufacturing Co.—Snap-action electric switch. 18th February, 1948. (649821.)

5040. Arrow Electric Switches, Ltd.—Push-pull electric selector switches. 20th February, 1948. (649822.)

5972. Department of Commerce, Director of the Office of Technical Services of.—Fluid-pressure-operated electric switches. 27th February, 1948. (649823.)

6067. Western Electric Co., Inc.—Signalling systems using coded pulses. 27th February, 1948. (649825.)

7257. Etablissements Merlin & Gerin.—Remote control electric circuits. 9th March, 1948. (649929.)

8043. Block, W. E. H.—Ceramic insulating material of low dielectric loss and great mechanical strength. 5th March, 1949. (649936.)

9306. Standard Telephones & Cables, Ltd.—Electric saw-tooth wave generators. 2nd April, 1948. (649995.)

9383. Hughes & Son, Ltd., H., and Sproule, D. O.—Generation of an intermittent electric current. 8th March, 1949. (649939.)

11180. Standard Telephones & Cables, Ltd. (Federal Telecommunication Laboratories, Inc.).—Electric pulse communication systems employing supersonic cells. 23rd April, 1948. (649998.)

11491. Martin, H.—Methods and apparatus for the electric arc welding of metal or alloy studs, tubes and the like metal or alloy plates, bodies and the like. 27th April, 1949. (649951.)

11881. Harnischfeger Corporation.—Apparatus for supplying alternating current for arc welding. 30th April, 1948. (649832.)

12045. Best Products, Ltd., and Best, F. L.—Safety switches for electric heating elements. 26th April, 1949. (649833.)

12141. Murray, W.—Automatic controls for electric heaters and other purposes. 28th April, 1949. (650000.)

11069. General Motors Corporation.—Radio tuning circuits. 25th May, 1948. (649959.)

11921. Warner Electric Brake Manufacturing Co. Magnetic friction element. 2nd June, 1948. (649961.)

16225. Radio Corporation of America.—Automatic reset time-delay relay. 16th June, 1948. (649840.)

19709. Standard Telephones & Cables, Ltd., and Harling, J. W. Circuits including negative resistance devices. 22nd July, 1949. (650007.)

20674. Lee, D. F.—High-tension supply-circuits. 5th August, 1949. (650008.)

21198. Pye, Ltd., Tanks & Linings, Ltd., and Pound, J. P.—High-frequency welding apparatus. 24th November, 1949. (649853.)

21826. British Thomson-Houston Co., Ltd.—Dynamo-electric machines. 18th August, 1948. (650011.)

22420. British Thomson-Houston Co., Ltd., and Maggs, A. H.—Dynamo-electric machines. 15th August, 1949. (649861.)

22825. Varley Dry Accumulators, Ltd., Fuller, L., and Szper, J. A.—Separators for electric secondary batteries. 30th August, 1949. (649866.)

23008. Westinghouse Electric International Co.—Excess voltage protective devices. 1st September, 1948. (650013.)

23018. Stivin, J.—Means for controlling an adjustable amount of electrical energy. 1st September, 1948. (649868.)

23225. Allmanna Svenska Elektriska Aktiebolaget, and Kvist, A.—Tubular elements for heat-exchange apparatus. 3rd September, 1948. (649870.)

23835. Standard Telephones & Cables, Ltd., Terry, V. J., and Hargreaves, T. F. S.—Modulators for carrier telegraph systems. 10th September, 1948. (650015.)

24078. Pirelli-General Cable Works, Ltd.—Multiple extrusion dies for applying insulation to the cores of electric cables. 14th September, 1948. (649873.)

24240. Tesla National Corporation, and Vackar, J.—Wattmeter for electric high-frequency currents. 15th September, 1948. (649874.)

24619. Titterton, E. W., and Voorhies, H. G.—High voltage supply systems for X-ray tubes. 20th September, 1948. (649876.)

24776. Tappenden, E. W.—Electric switch for the battery circuits of motor vehicles or the like. 22nd September, 1948. (649878.)

25602. Wingrave, F. H.—Electric signs. 1st October, 1948. (649881.)

26028. Scintex Soc. Anon.—Electric time-switch notably for controlling signalling circuits on automobiles. 6th October, 1948. (649884.)

26722. Babcock & Wilcox, Ltd.—Electric arc welding. 11th October, 1948. (649888.)

27905. Automatic Coil Winder & Electrical Equipment Co., Ltd., and Wilkins, S. R.—Electrical measuring instruments. 27th October, 1949. (649894.)

28546. Mullard Radio Valve Co., Ltd., Dell, H. A., Caple, K. M., and Beaven, C. H. J.—Cathode-ray tubes and circuit-arrangements therefor. 2nd December, 1949. (650019.)

28659. Clang, Ltd., and Jones, N.—Electric lampholder skirts. 4th November, 1949. (650020.)

I.E.E. Western Centre

THE annual dinner and dance of the Western Centre and West Wales Sub-Centre of the Institution of Electrical Engineers will be held on 16th February at the Seabank Hotel, Porthcawl. Tickets for the dinner and dance are £1 1s each while students and graduates can obtain tickets at 6s 6d each for the dance only. Applications should be made to Mr. J. Gill, hon. assistant secretary, Western Centre, Metropolitan-Vickers Electrical Co., Ltd., Mervyn House, Frederick Street, Cardiff.

Re-Appointments to Electricity Boards

THE Minister of Fuel and Power announces that he has re-appointed the following part-time members of Area Electricity Boards:—

LONDON.—Alderman C. W. Dixon, J.P., Mrs. George Dunbar, O.B.E., Dr. P. Dunsheath, C.B.E., Mr. G. Eley, C.B.E., Mr. W. A. Jones, A.M.I.E.E., and Mr. W. J. H. Wood, M.I.E.E.

SOUTH EASTERN.—Mr. George Humphreys, and Alderman E. Simms.

SOUTHERN.—Alderman J. P. D. Lacey, O.B.E.

SOUTH WESTERN.—Mr. H. M. Medland.

EASTERN.—Capt. J. M. Donaldson, M.C., M.Inst.C.E., M.I.E.E., Mr. W. J. Humphreys, J.P., and Sir Cecil Oakes, C.B.E.

EAST MIDLANDS.—Mr. J. T. Graham, A.R.T.C., M.I.Mech.E., Alderman A. Joyce, C.B.E., and Mr. G. H. B. Wilson, C.B.E.

MIDLANDS.—Councillor A. E. Bennett, J.P., Mr. S. F. Burman, M.B.E., and Capt. L. H. Green, M.B.E.

SOUTH WALES.—Sir Gerald Bruce, K.C.B., Mr. Basil Curran, Alderman T. Evans, J.P., and Principal Robert James, A.M.I.Mech.E.

MERSEYSIDE AND NORTH WALES.—Mr. J. A. Duncan, B.Sc., Alderman A. Hewitt, O.B.E., Mr. G. K. Paton, M.I.E.E., and Sir Arthur Pickup.

YORKSHIRE.—Mr. H. F. Sherborne, M.C., M.A.

NORTH EASTERN.—Councillor Miss N. Balls, J.P., and Mr. C. I. C. Bosanquet, M.A.

NORTH WESTERN.—Miss N. Kenyon, Alderman H. E. Rhodes, J.P., and Col. J. S. A. Walker, T.D., M.Inst.C.E.

SOUTH EAST SCOTLAND.—Mr. R. W. McCrone, M.C., B.Sc.(Eng.), Mr. George McLaren, C.B.E., Sir Ronald Thomson, and Sir Ernest Wedderburn, O.B.E.

SOUTH WEST SCOTLAND.—Col. J. G. Crabbe, O.B.E., Mr. J. B. Mavor, M.I.E.E., Mr. Jackson Millar, C.B.E., Mr. George Morgan, M.I.E.E., Mr. Thomas Murray, J.P., and Councillor J. Sullivan.

Brightness Engineering

THE study of what has somewhat clumsily been called "brightness engineering" and its relationship to comfortable seeing by artificial light was the subject of discussion at the monthly meeting of the Illuminating Engineering Society in London this week.

Mr. W. Robinson (E.D.A.) explained in a paper that to enable vision to be sustained comfortably it was advisable to control the brightness of interiors in relation to that of the light sources and the objects being worked upon. There was a growing tendency to employ a 3:1 ratio as a guide, which the author suggested should be adopted as a provisional code pending further investigation.

Brightness design data were now available in the form of inter-reflection tables which enabled the average brightness of floor, walls and ceilings to be predetermined in a manner similar to the predetermination of illumination from coefficient of utilization tables.

The tables were based on the use of a "room coefficient" which, as with the lumen design "room index," was a simple function of the room dimensions. All interiors, regardless of size or dimensions, which had the same value of room coefficient had the same inter-reflection characteristics and it had therefore been possible to provide comprehensive inter-reflection data covering a very wide range of interior sizes and shapes in a compact set of tables. The brightnesses in foot-lamberts of the various room surfaces were given in appropriate tables as a proportion of the average horizontal room illumination; their predetermination resolved itself into a simple additional step in the normal illumination design process.

A brief description was given of the "field flux" method of design in which emphasis was placed on the zonal distribution of light flux rather than on brightness ratios. The criterion was based on natural light out of doors which had been judged from observations to be most acceptable to human beings. These optimum visual conditions were measured by a special instrument and transferred to a flux chart, which was used as a basis for interior lighting design. By use of inter-reflection tables and special design methods, interior lighting was made to reproduce, as far as possible, those optimum visual conditions. Though the methods of brightness measurement now available were technically adequate, cheaper and more compact instruments would no doubt be developed.

Whitaker's Almanack

THE 1951 "Whitaker's Almanack" (the 83rd) appeared before Christmas for the first time since the war and it is of a record size (1,156 pp.). As usual it contains a vast amount of well-collated and varied information, including the results of the 1950 General Election and full particulars of the reconstituted Government. Two pre-war features, articles dealing with London churches and other places of interest, have been restored. Particular interest attaches to the international section and the review of the past year's events. The directory section has been rearranged for convenience of reference. The price of the full edition, obtainable from the publishers at 13, Bedford Square, London, W.C.1, is 12s 6d. There is a shorter edition at 7s 6d and a library edition at 25s.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Australia.—BRISBANE.—9th February. City Electricity Department. High voltage Schering bridge. (C.R.E. (I.B.) 74020/50. Ten/2007.)*

Baildon (Yorks).—31st January. U.D.C. Concrete standards, lanterns and control gear for m.v. lamps. (See this issue.)

Belfast.—2nd February. Electricity Department. Stores, including transformer kiosks, boiler-house spare parts, domestic appliances, etc. (See this issue.)

2nd February. City Council. Fire-fighting equipment for 33 kV substation switchgear. (See 5th January issue.)

Bombay.—Port Trust. Thirty-four electric cranes. (See this issue.)

Carlisle.—26th January. City Council. Electrical installation at the Belah Junior and Infants' School. (See 5th January issue.)

Castle Ward (Northumberland).—R.D.C. Electrical installations in twenty-six houses at Stamfordham. Mr. G. E. Dimmack, surveyor, North Road, Ponteland.

Colwyn Bay.—3rd February. U.D.C. Two electric centrifugal booster pumps, for the Llanelian water supply scheme. Borough surveyor, Town Hall.

Leeds.—10th February. City Council. Supply of 660 V cables, junction boxes and telephone cables. (See this issue.)

Lincolnshire.—County Council. Installation of heating, hot and cold water and ventilation services, and electrical installation at proposed technical college, Scunthorpe. (See this issue.)

London.—STEPNEY.—15th January. Borough Council. Fluorescent lighting at Whitechapel Public Library. (See 5th January issue.)

Luton.—5th February. Borough Council. Installation of electrical services at Whipperley County Primary Infants' School. (See this issue.)

Newcastle-on-Tyne.—City Council. Installation of electric lighting in 770 Council houses. The contract will be allocated in groups of 100. City architect, 18, Cloth Market.

New Zealand.—WELLINGTON.—30th January. Post Office. Switchboard cable. (C.R.E. (I.B.) 74055/50. Ten/2005.)* 13th March. State Hydro-Electric Department. Two auxiliary sets for the Whakamaru power station each set comprising a 420 b.h.p. water driven turbine and a 350 kVA generator, together with accessories. (C.R.E. (I.B.) 74200/50. Ten/2008.)* 1st May. Galvanized steel transmission line towers. (C.R.E. (I.B.) 74057/50. Ten/2009.)*

Pakistan.—13th February. High Commissioner for Pakistan, London. Wireless sets No. 22, kit No. 3, etc. (See this issue.)

Sunderland.—Education Committee. Electrical installation at Thorney Close Secondary Modern Schools. S. W. Milburn and Partners, architects, 9, Esplanade.

Swansea.—3rd February. Borough Council. Electric lamps for public lighting for one year. Borough surveyor, Guildhall.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1 (Victoria 9040).

ORDERS PLACED

Cheshire.—County Council. Electrical installation at new primary school, Overpool, Ellesmere Port, and new primary school, Cuddington, Northwich.—Cohen Bros. (Electrical), Ltd.

Ipswich.—East Anglian Regional Hospital Board. Electrical engineering services at the sanatorium (£2,212).—Mann, Egerton & Co., Ltd.

Middlesbrough.—Town Council. Installation of electric lighting in new office extensions for the Borough Engineer's Department (£570).—North Eastern Electricity Board.

Newcastle-on-Tyne.—Education Committee. Electrical installation at the Ravenswood Road County Primary School (£5,495).—R. V. Hogg & Co.

Rothbury (Northumberland).—R.D.C. Electrical installations in 10 houses at Longframlington (£196).—J. R. Tweedy.

Sheffield.—Corporation. Installation of electric lighting at the Acres Hill County Junior School (£2,547), and Greenhill County Junior and Infants' School (£4,076).—A. S. Bennett.

South Shields.—Education Committee. Electrical work at Simonside County Infants' School (£1,631).—Law and Burns.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aldershot.—Factory for H. Comoy & Co., Ltd., 72, Rosebery Avenue, E.C.1.; H. W. Sisk, Ltd., builders, 2, Wharf Street, Godalming.

Ashton-under-Lyne.—36 houses at Hutton Lane, and 10 at Crowhill for B.C.; Geo. Wimpey & Co., Ltd.

Banbury.—Technical wing for College of Further Education, for Oxfordshire E.C.; G. R. Hutton, architect, 3, Becket Street, Oxford.

Beadlam.—School for North Riding E.C.; J. H. Napper, 56, Eldon Place, Newcastle-upon-Tyne.

Blackpool.—1951 Schools Programme. Mereside County Infants, Little Marton (£39,700). Junior department of St. Cuthbert's R.C. Primary, Stanley Road (£53,200); A. S. Hamilton, borough engineer.

Bristol.—Additions to Parklands, Tyndalls Park Road, including two new wings, etc., for the South Western Regional Hospital Board; architect to the Board, 2, Elton Road, Clifton.

Bromsgrove.—Further 40 houses at Charford estate for U.D.C.; Mackee & Rodway, Ltd., Northfield.

Carlton.—Ten blocks of flats (40 units), Valley Road, for U.D.C.; J. R. Campbell, surveyor, Burton Road.

Coventry.—Newspaper offices and works (£350,000), for Coventry Newspapers, Ltd.; L. A. Culliford and Partners, architects, 47, Essex Street, Strand, London, W.C.2.

Crewe.—Proposed ambulance depot (£9,000) for Cheshire C.C.; F. M. Parkes, county architect.

Dewsbury.—Houses (110) at Chickenley site for B.C.; Harlow & Milner, Ltd., Warren Yard, Warrengate, Wakefield.

Dukinfield.—Houses (36) at Yew Tree Lane site; Cruikshank and Seward, architects, 16, Princess Street, Manchester.

Durham.—Houses (120); housing architect, Rural Council, Byland Lodge.

Ellesmere Port.—Houses (350), four shops and 30-40 garages at North Whitby estate for U.D.C.; C. W. Davis, surveyor.

Filey.—Houses (43), Muston Road site, for U.D.C.; F. Vaux, architect, 31, Quay Road, Bridlington.

Gosport.—Houses (89), Rowner estate, for T.C.; borough engineer.

Grimsby.—Houses (350) for T.C.; borough surveyor.

Harraby.—Erection of egg grading station for West Cumberland Farmers' Association; John Laing & Son, Carlisle.

Harrogate.—Ice skating rink, bathing pool, etc., Royal Hall Gardens, for T.C.; borough surveyor, Municipal Offices.

Horncastle.—School, Bowl Alley Lane (£59,500), for Lindsey C.C.; M. J. Gleeson, Ltd., builders, Chesterfield Road, Sheffield.

Huddersfield.—Health centre, for T.C.; N. Nuttall, borough architect, High Street Buildings.

Ilford.—Licensed premises, New North Road; Mann, Crossman & Paulin, Ltd., Mile End Road, E.1.

Kidderminster.—School for C.C.; F. W. B. Yorke and Barker, architects, 36, Calthorpe Road, Birmingham.

Lancashire.—Nursery school at Darwen Chapels (£13,380); G. Noel Hill, county architect, Preston.

Lindsey.—Junior school at Bowl Alley Lane, Horncastle, for C.C.; M. J. Gleeson, Ltd., Sheffield.

Liverpool.—Café and conveniences at Speke Hall; Dr. R. Bradbury, city architect.

Erection of Childwall Hall County College for E.C.; Tysons (Contractors), Ltd.

London.—Two large buildings, Carlton House Terrace site, S.W.1, for the Foreign Office; Louis de Soissons and Partners, architects, W.1.

FINSBURY.—Flats (180), Old Street area, for B.C.; J. Emberton, architect, Chantry House, Eccleston Street, S.W.1.

MAYFAIR.—Block of offices, Stratton Street; Val Myer, Hart and Willis, architects, 22, Grosvenor Crescent Mews, S.W.1.

PADDINGTON.—Flats (167), Hall Park area, for B.C.; borough housing architect.

WOOLWICH.—Houses (128), Coldharbour estate, for B.C.; borough engineer.

Morpeth.—Electrical installations in 175 houses; borough surveyor.

Newport (Isle of Wight).—Flats (16) and 44 houses, third section of Pan estate, for T.C.; Ernest L. Smith & Son, architects, Melville Chambers, Sandown.

Northamptonshire. — County infants' school at Corby, technical institute at Kettering, and extensions to County Modern School, Rushden, for E.C.; county architect, County Hall, Northampton.

Peterborough.—Houses (100), Eastfield estate, in six groups, for T.C.; F. J. Smith, city surveyor, Town Hall.

Prudhoe.—School; county architect, County Hall, Newcastle-upon-Tyne.

Reading.—Flats (60), Gorsbrook Road, Caversham; James and Bywaters, architects to T.C., 5, Bloomsbury Street, London, W.C.1.

Ruislip.—Flats (48), Southcote Rise, for U.D.C.; surveyor.

Stalybridge.—Houses (40) at Buckton Vale site for B.C.; Howard and Benson, architects, 88, Mosley Street, Manchester.

Stockport.—Houses (29) and two flats at Brinnington estate; G. A. Lomas & Co., Ltd., Ungard Lane, Brinnington.

Twin operating theatre at Stepping Hill Hospital; Harry S. Fairhurst & Son, architects, Brown Street, Manchester.

Swansea.—Primary School, East Penlan, for T.C.; borough architect.

Wolverton.—Workshop block for Technical College, for Bucks E.C.; county architect, County Hall, Aylesbury.

Wooler.—School for Northumberland E.C.; E. Jeffock, Ltd., Wabbottle Road, Newburn-on-Tyne.

Bus station, for United Automobile Services, Ltd.; A. A. Briggs, architect, 10, Fleet Street, E.C.4.

Worcester.—Abattoir on site adjoining Pitchcroft (£40,000), for T.C.; city engineer, 22, Bridge Street.